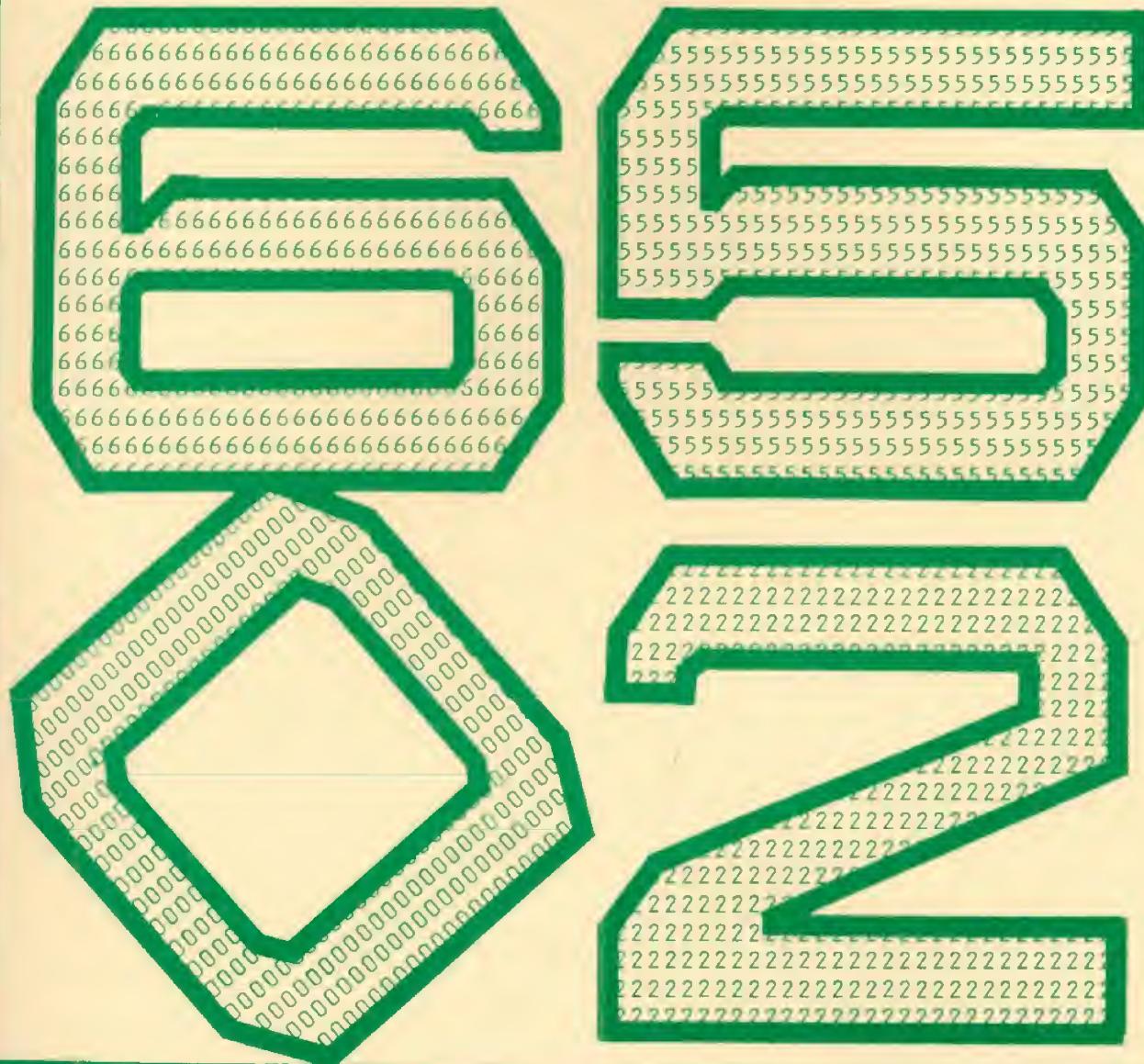


# MICRO™

# The Magazine of the **APPLE, KIM, PET** and Other **6502** Systems



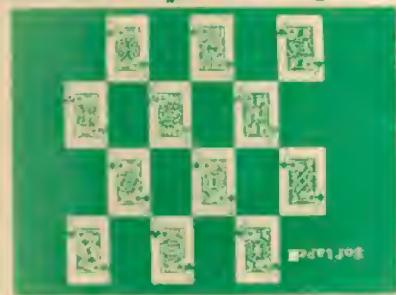
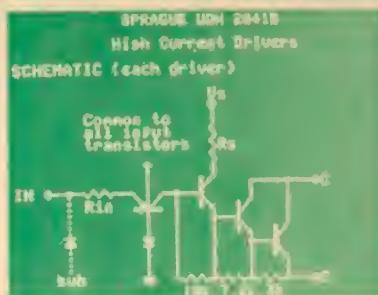
**NO 12**

**May**

**1979**

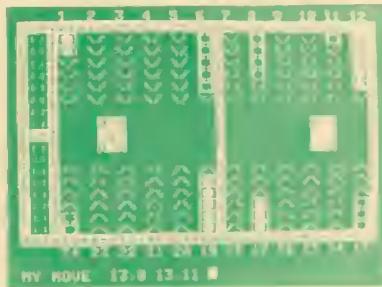
**\$1.50**

# APPLE HI-RES GRAPHICS: The Screen Machine by Softape



Open the manual and LOAD the cassette. Then get ready to explore the world of 'Programmable Characters' with the SCREEN MACHINE™. You can now create new character sets — foreign alphabets, electronic symbols and even Hi-Res playing cards, or, use the standard upper and lower case ASCII character set.

The "SCREEN MACHINE" lets you redefine any keyboard character. Just create any symbol using a few easy key strokes and the "SCREEN MACHINE" will assign that symbol to the key of your choice. For example: create a symbol, an upside down "A" and assign it to the keyboard 'A' key. Now every time you press the 'A' key or when the Apple prints an 'A' it will appear upside down. Any shape can be assigned to any key!



**MICROGAMMON 1.0** Learn, practice and enhance your Backgammon ability with a true competitor. . . . . \$14.95

**APPLE-LIS'NER** Voice recognition Software. Create your own programs which 'listen' and understand 31 spoken words — English or Foreign. No hardware needed. . . . . \$19.95

**APPLE TALKER** Your Apple's voice. Create programs which talk to you in English or Spanish or any language. . . . . \$15.95

**JUPITER EXPRESS** Command your ship thru the hazards of the Asteroid belt between Mars and Jupiter. . . . . \$9.95

**FORTE'** A music language, written like basic, you use line numbers for your notes. You can trace line numbers or notes. You can even print the words of any song. Save your song to your Disk. . . . . \$19.95

**FORTH** is the creation of Wm. Graves. This language gives you faster execution of programs than basic and is easier to program than machine language. Our 100 page manual will teach you everything you will need. FORTH comes complete with demo programs on one Apple diskette. . . . . \$49.95

**WHERE TO GET IT:** Look for the SOFTAPE Software display in your local computer store. Apple dealers throughout the United States, Canada, South America, Europe and Australia carry the SOFTAPE Software line of quality products.

If your local dealer is sold out of SOFTAPE Software you can order it direct from us by check or Visa/Master Charge. If you have any questions please call us at:



1-213-985-5763



Or mail your order to the address below. We'll add your name to our mailing list for free literature and announcements of new products.

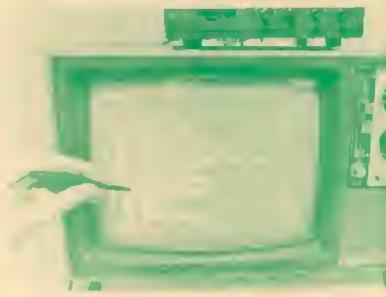
# SOFTAPE

10432 Burbank Blvd. • North Hollywood, CA 91601

The "SCREEN MACHINE" gives you the option of saving your character symbols to disk or tape for later use. There is no complicated 'patching' needed. The SCREEN MACHINE is transparent to your programs. Just print the new character with a basic print statement. The "SCREEN MACHINE" is very easy to use.

Included on the cassette are Apple Hi-Res routines in SOFTAPES prefix format. You can use both Apple's, routines and the SCREEN MACHINE to create microcomputing's best graphics.

Cassette, and Documentation, a complete package . . . . . \$19.95



**BRIGHT PEN** What is the difference between a light and a Bright Pen? Intelligent Software and extensive documentation. . . . . \$34.95



# MICRO™

MAY 1979

ISSUE NUMBER TWELVE

## TABLE OF CONTENTS

MICRO Interrupts	3
An AIM 65 User's Notes by Joe Burnett	5
S-C Assembler II by Chuck Carpenter	9
A PET Hex Dump Program by Joseph Donato	13
Super HI-LO for the SYM-1 by John Gieryc	17
A 100 uS 16 Channel Analog to Digital Converter ... by J. C. Williams	25
Real-Time Games on OSI by David Morganstein	31
ASK the Doctor - Part IV - Good News/ Bad News by Robert M. Tripp	35
MICRO Software Catalog: VIII by Mike Rowe	37
Inside the KIM TTY Service by Ben Doutre	39
The Integer BASIC Token System in the Apple II by Frank Kirschner	41
Programming the 6502: by Rodney Zaks reviewed by John D. Hirsch	44
Renumber Applesoft by Chuck Carpenter	45
MICRO Index Volume II, Numbers 7 to 12	47

# MICRO™

## STAFF

Editor/Publisher  
Robert M. Tripp  
Business Manager  
Donna M. Tripp  
Administrative Assistant  
Maggie Fisher  
Circulation Manager  
Carol A. Stark  
Distribution  
Eileen M. Enos  
Janet Santaguida  
Micro-Systems Lab  
James R. Witt, Jr.  
Stephen L. Allen  
Chief Gofer  
Fred Davis

MICRO™ is published monthly by:  
The COMPUTERIST®, Inc.  
P.O. Box 3  
So. Chelmsford, MA 01824  
Controlled Circulation postage paid at:  
Chelmsford, MA 01824  
Publication Number: COTR 395770  
Subscription in US: \$12.00/12 Issues  
Entire contents copyright • 1979 by:  
The COMPUTERIST®, Inc.

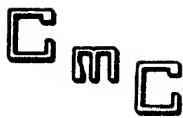
## ADVERTISER'S INDEX

CAP Electronics	33	Micro Technology Unlimited	22
Connecticut microComputer	2	Optimal Technology, Inc.	40
COMPAS Microsystems	IBC	P.S. Software House	33
Computer Components	34	Plainsman Micro Systems	40
Computer Forum	24	Programma International	8
The COMPUTERIST, Inc.	44	Progressive Software	26
Excert, Inc.	4	RNB Enterprises	16
H. Geller Computer Systems	17	Seawell Marketing	23
Hudson Digital Electronics	30	Softape	IFC
MICRO	44	Softside Software	12
		Speakeasy Software	BC

Please address all correspondence, subscriptions and address changes to:

MICRO, P.O. Box 6502, So. Chelmsford, MA 01824  
617/256-5515

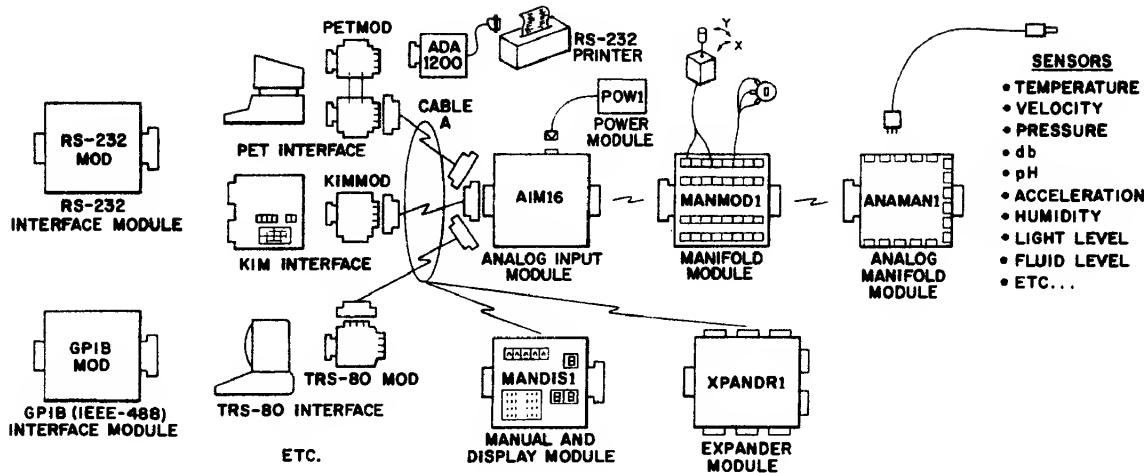
# MICRO™



# CONNECTICUT microCOMPUTER, Inc.

150 POCONO ROAD - BROOKFIELD, CONNECTICUT 06804

(203) 775-9659



DAM SYSTEMS by CMC  
A complete system of modules to let your computer listen  
to the real world.

## DAM SYSTEMS PRICE LIST

### DAM SYSTEMS Components

**AIM161 - Analog Input Module**  
16 8-bit analog inputs - 100 microsecond conversion time -  
3 state output - requires one 8-bit computer output port  
for control and one 8-bit computer input port for data.

\$179.00

**KIMMOD - KIM Interface Module**  
Gives one application connector port and one DAM SYSTEMS  
interface port. \$39.95

**AIM162 - Analog Input Module**  
As above plus: greater accuracy - gold plated contacts -  
pilot light - switch selectable start/enable and ready  
polarities.

\$249.00

**CABLE "A" - Interconnect Cables**  
Connects computer interface to AIM16, MANDIS1, XPANDR1,  
etc. TBA

**POW1 - Power Module**  
Supplies power for one AIM16 module.

\$14.95

**CABLE A24 - Interconnect Cable**  
24 inch cable with interface connector on one end and an  
OCOM equivalent on the other. \$19.95

**ICON - Input Connector**  
For connecting analog inputs to the AIM16 - 20 pin card  
edge connector - solder eyelets.

\$9.95

**MANDIS1 - Manual and Display Module**  
Connects between the AIM16 and the computer interface.  
Allows manual or computer control of the AIM16. Displays  
channel number and data. TBA

**OCON - Output Connector**  
For connecting the AIM16 to a computer - 20 pin card edge  
connector - solder eyelets.

\$9.95

**GPIB MOD - GPIB ( IEEE-488 ) Interface**  
Allows the DAM SYSTEMS MODULES to be used with the GPIB bus  
instead of a computer's other I/O ports. TBA

**MANMOD1 - Manifold Module**  
Use in place of ICON. Screen terminal barrier strips for  
connecting joysticks, potentiometers, voltage sources, etc.  
Eliminates the need for soldering. Plugs into the AIM16.

\$59.95

**RS232 MOD - RS232 Interface Module**  
Allows the DAM SYSTEMS MODULES to be used with an RS-232  
port or terminal. TBA

**ANAMAN1 - Analog Manifold Module**  
Use in place of ICON. Connects DAM SYSTEMS SENSORS to the  
AIM16 without soldering - sensor cables just plug in. Plugs  
into the AIM16 or the MANMOD1.

TBA

**XPANDR1 - Expander Module**  
Allows up to 128 8-bit analog inputs (8 AIM16 Modules) to  
be connected to one system. TBA

**SENSORS**  
Sensors for temperature, pressure, flow, humidity, level,  
pH, motion, etc.

TBA

**DAM SYSTEMS sets**

**COMPUTER INTERFACES**  
For the PET, KIM, TRS-80, etc. Use in place of OCON.  
Eliminates the need for soldering or special construction.

TBA

**AIM161 Starter Set**  
Includes one AIM161, one POW1, one ICON and one OCON. \$189.00

**PETMOD - PET Interface Module**  
Gives two IEEE ports, one user port and one DAM SYSTEMS  
interface port. Saves wear and tear on the PET's printed  
circuit board. Also called the PETSWAR.

\$49.95

**AIM162 Starter Set**  
Includes one AIM162, one POW1, one ICON and one OCON. \$259.00

**PETSET1a**  
Includes one PETMOD, one CABLE A24, one AIM161, one POW1 and  
one MANMOD1. \$295.00

**KIMSET1a**  
Includes one KIMMOD, one CABLE A24, one AIM161, one POW1 and  
one MANMOD1. \$285.00

## MICRO INTERRUPTS

### NEXT IN THIS ISSUE

While this space is usually used to discuss the contents of the current issue, I would like to use it this month to talk about the exciting new changes coming up in the June 1979 issue of MICRO. These changes reflect our continuing effort to make MICRO even better than before.

The most significant change is that MICRO will be increased in size from the current 52 pages up to 68 pages. This is due to the continuing growth of both the articles submitted for publication and the increased interest in advertising in MICRO. The 16 page expansion will support growth in both of these areas.

The second most important change is that MICRO is going to be printed by a more sophisticated printing method. It will be printed on glossy stock which make for easier-to-read text, permits far superior halftones, and is slightly lighter so that mailing costs will remain about the same even though the size has increased.

One objection I have had to the current format of MICRO, an objection that has also been voiced by others, is that while the articles are the important part of MICRO, the overall magazine is a bit heavy or dry. To overcome this, some of the new space will be used for news, informal discussions, points-of-view, and so forth. I do not plan to publish "love-letters", but if you have something to say that may not merit an entire article - then write a short note. We will make room for these less formal presentations.

The overall appearance of MICRO will be improved - from the two color cover to the interior layout. We have analysed a number of other magazines and tried to "lift" those features that made them interesting and readable. I know that there are some "purists" in the audience who will object to any changes in the magazine, but I feel that most readers will appreciate the improvements. Some of the current features that we will definitely maintain are: the three-hole punch, the organization of each article into contiguous pages generally unbroken by ads, the protective mailing cover, and, of course, the editorial direction toward useful features and articles over games and "blue-sky" speculation.

With the increase in size and production cost, there will be an increase in price - but not that much. The retail price will increase to \$2.00, but the subscription will only increase to \$1.25 or \$15.00 per year in the US. This is the first increase in price since we began 12 issues ago. Subscriptions will be accepted at the old rate until June 1, 1979 - so you may want to renew ahead (but only for one year).

### MICROBES

EKIM or MAXI-KIM, MICRO 11:20

17D1 B0 AD BCS START should have been  
17D1 B0 B4 BCS GETK

Robert A. Stein, Jr. reports that the table of memory size changes in "A CASSETTE OPERATING SYSTEM FOR THE APPLE II", MICRO 11:21 has some errors. The corrected table appears below:

If using CASSOS in other than a 16K machine change location \$0358 as follows:

1F-8K 2F-12K 3F-16K 4F-20K 5F-24K 7F-32K  
8F-36K BF-48K

### CLUB ANNOUNCEMENTS

#### APPLESEED

c/o The Computer Shop  
6812 San Pedro

San Antonio, TX 78216

(No information was included on their current meeting dates, nor was there a phone number given. This info would make the announcement much more useful !!)

An attempt is being made to organize an Apple group in New Hampshire. If you are interested, please contact:

Steve Adams  
Governor Weare Apts.  
Bldg. 1, Apt. 2  
Seabrook, NH 03874  
603/474-2230

#### ACG of NJ 6502/6800 User Group

Lew Edwards reports that the group is very active. "Meetings on 4th Friday at Union County Technical Institute have all kinds of expanded KIM's, PET's, an Apple group as well as AIM's and SYM's starting to show up. It's a wonderful way for beginners to get help from others in solving problems, getting their systems up and running, etc. Has really been taking off the last 6-7 months."

#### ABACUS (Apple Bay Area Computer Users Society)

Hayward BYTE Shop  
1122 B Street  
Hayward, CA

David R. Wilkerson, Secretary writes: "We have an active membership of 40, and we have developed a club library of 200+ programs. Currently we are negotiating to trade libraries with several other clubs." For more info call:

Ed Avelar, President  
415/583-2431

#### Northwest Suburban Apple II Users Group

"Serving Apple II users in the Northwest Suburban Chicago area, we provide a forum for the interchange of knowledge, problems and application of the Apple II computer. Meetings are held the first Saturday of each month at the Palatine, Illinois Park District facility."

For more information please contact:

Ken Rose  
650 Pompano Lane  
Palatine, IL 60067  
312/359-6723

#### ATTENTION ALL 6502 CLUBS

MICRO will be happy to donate a free six month subscription to any legitimate 6502 oriented club or user group. There are only two requirements for this offer:

1. A copy of the club/group mailing list must be sent to MICRO. This both shows that you are a real club and lets MICRO send a flyer to your members describing our publication.
2. Regular notification of meetings and events must be provided for this column. This will help us inform more potential members about your organization.

\*\*\*\*\* AIM-65 \*\*\*\*\*

<u>P/N</u>		<u>Qty 1-9</u>
A65-1	AIM-65 w/1K RAM	\$375
A65-4	AIM-65 w/4K RAM	\$450
A65-A	Assembler ROM	\$85
A65-B	BASIC ROMS	\$100

ACCESSORIES

<u>P/N</u>							
PRS1	+5V at 5A, +24V at 2.5A +12V at 1A (does not fit inside ENC1)	\$95	All AIM-65 systems are assembled and tested.				
PRS2	+5V at 5A, +24V at 1A (mounts inside ENC1)	50	"A" series have the power supply external (PRS1).				
ENC1	AIM-65 case w/space for PRS2 and MEB1	45	"B" series have the power supply mounted inside (PRS2).				
MEB1	Memory expansion bd w/8K RAM; 8K PROM sockets and programmer for 2716; 6522 I/O chip	245	<u>P/N</u>	<u>"A"</u>	<u>"B"</u>		
MEB2	Memory expansion bd w/16K RAM populated w/2114's Unpopulated	325 125	S_65-1    A65-1 in ENC1 S_65-1B   Same Plus BASIC S_65-4    A65-4 in ENC1 S_65-4B   Same Plus BASIC	\$495    \$475 595    575 560    540 660    640			
VJBL	Video bd w/128 char, 128 user char, prog. up to 100 char/line, up to 4K RAM, light pen interface and ASCII kybd interface	245	<u>"STARTER" SYSTEMS</u>				
Thermal Paper Tape, 9/85' rolls	10	E_65-1    A65-1, ENC1, MEB1 E_65-1B   Same Plus BASIC E_65-4    A65-4, ENC1, MEB1 E_65-4B   Same Plus BASIC	\$730    \$710 830    810 795    775 895    875	<u>"EXPANDED" SYSTEMS</u>			

Higher quantities and systems with other options quoted upon request!

Mail Check or Money Order:

EXCERT, INCORPORATED  
Attn: Laurie  
4434 Thomas Avenue South  
Minneapolis, Minnesota 55410  
(612) 920-7792

Add \$5.00 for shipping, insurance, and handling.

Minnesota residents add 4% sales tax.

## AN AIM 65 USER'S NOTES

Joe Burnett

16492 E. Tennessee Avenue

Aurora, CO 80012

The AIM 65 Microcomputer, made by Rockwell, is one of the newest, most versatile home computers available today. At the time of this writing (January 1979), it sells for \$375. For this you get the complete computer, with a 20 character alphanumeric display, full size alphanumeric keyboard, a printer which uses inexpensive calculator type paper, 1K of RAM and 8K ROM-resident programming. Options include the ability to add 3K more memory, a 4K assembler, and an 8K Basic interpreter, all on-board, simply by purchasing them and plugging them in. An "application" connector and an "expansion" connector accept standard 44 pin edge connectors, and allow the control and I/O of two cassette units and a teletype, as well as off-board additional memory. On-board programming (ROM-resident) gives you the ability to display memory in either hex or mnemonic, alter memory, edit programming, turn the printer on and off, display registers, and enter any of the many resident subroutines. With cassette units connected, you can read or write to either one, and set up the AIM 65 to handle KIM-1 format (X1 or X3) or the AIM 65 format software. The AIM 65 will file and search cassette tapes, and the front panel alphanumeric display lets you know the status of the operation in progress as well as the block of data being read or written. Three keys on the keyboard (F1, F2, and F3) enable user defined functions through programmed jump instructions, and are a nice feature. Physically, the computer circuit board itself is ten inches deep by twelve inches wide, and the keyboard (which attaches through a supplied ribbon cable) is four inches deep by twelve inches wide. Included with the computer is a roll of paper for the printer, "feet" for the computer circuit board and the keyboard circuit, a User's Guide manual, an R6500 Programming manual, a System Hardware manual, a Programming Reference Card, an AIM 65 Summary Card, and a large schematic diagram, as well as the warranty card (don't forget to mail this in).

### Software Compatibility

As with any new product, there are some problems. One is with the KIM-1 software. The KIM-1 is a very basic computer, and the AIM 65 is sophisticated by comparison. An example of the problem with the software is the KIM-1 "PLEASE" program. "PLEASE" loads data into memory locations which either are dedicated for use by the AIM 65, or are not present in the AIM 65. Consequently, although the AIM 65 can be initialized to accept KIM-1 programming, check the listing before you try to do it. It'll save you a lot of time and frustration. The AIM 65 User's Guide Manual includes a detailed memory map which you can use to determine (from a program listing) whether or not the program you're trying to load will in fact load as advertised.

### Some Cassette Control Problems

A second problem is with the cassette unit control circuitry. There are actually two circuits in the AIM 65 for each cassette unit, and although Rockwell made an attempt to cover all eventualities, they didn't succeed. The first circuit makes use of an integrated circuit relay driver, which puts a low (ground) at the cassette

control output pin of the "application" connector when the computer toggles the cassette unit "on". The second circuit is a transistor switch which is biased on when the computer toggles the cassette unit "on". The problem arises in that not all cassette units use a positive supply voltage with the negative line common (connected to the cassette unit frame). General Electric, for example, typically connects the positive side of the battery (or AC adapter) to the cassette unit frame, and uses negative voltage for the motor and electronic circuitry. At first glance, this doesn't look like a problem; after all, you only need to supply a closure to the remote switch line, and the cassette unit will run, right? Well, not quite. If you connect your GE cassette unit to the relay driver output pin, and the computer control has the cassette unit toggled "off", the cassette unit won't shut off. This is because you've put a negative voltage (from the cassette unit) at a point which has a nearly equal positive voltage (from the AIM 65), and the result is close enough to zero volts that the cassette unit motor runs even though the computer indicated that an "off" condition exists. Okay, so what about the transistor switch? Figure 9-4 of the User's Guide manual shows how to connect the wires. And the cassette unit won't run. At this point you're most likely very annoyed and confused (I know I was). The reason that the computer won't control the cassette unit is that (1) figure 9-4 of the User's Guide Manual is in error; the positive voltage from the cassette unit battery should go to pin "F", and the motor line should go to pin "E", of the "application" connector; and (2) the transistor does not have the voltages necessary to make it work, even after the wires are properly connected. If you look at the schematic diagram, you'll see that the transistor switch in the computer gets its operating voltage from the circuit it's controlling. To make it work, the transistor must have the proper bias (voltage between base and emitter), and to get this a common ground must exist between the computer power supply and the cassette unit power supply. It would seem that all that would be necessary would be to connect the emitter of the transistor (pin "F" of the "application" connector) to ground. Now the cassette unit will run and stop in response to computer control—until you plug in the ear and/or mic lines. When you do this, and the transistor turns on, you create a short circuit across the battery (or AC adapter) of the cassette unit. The reason is that when you wired up the ear/mic lines, you connected one side to ground on the 44 pin edge connector, and now the current finds a path through the cassette electronic circuitry, and everything stops. Under normal conditions, the remote switch on the cassette unit microphone is isolated from everything, so no problem exists. When you make the return line to the remote switch and the ear/mic line return common, a short circuit occurs. So what do you do now? Simulate an isolated switch, similar to what the microphone has. A relay is the only way, if you're going to control the cassette unit with the computer. Since my AIM 65 is still in the warranty period, I have not modified it as I'd like to. However, once the warranty period expires, I'm going to install two relays on the circuit board and use the transistor switches to control them. Then it won't matter what kind of motor control the cassette unit uses; I'll have the isolated switch action required to control any cassette unit, regardless of the polarity of the voltages involved.

### A Sample Program

At the time of this writing, neither the Assembler nor the BASIC interpreter is available from my distributor. This means that any programming I do has to be done using mnemonic codes. Although the documentation in the User's Guide is very good, the sample programs shown appear to have been produced with the use of an Assembler. An example is on pages 7-82 and 7-83. This program is intended to display and print an assembled message, but the information on how to prepare the message for storage in memory is absent. So, if you input this program you'll be "all dressed up with nowhere to go". The program shown below will allow you to input a message, and then retrieve it, all with the "bare bones" (1K RAM) AIM 65. How you use this is up to you. It could be just "for show", or you can modify it as desired and

include it in more complex routines involving user interaction with the computer. This program does feature single key access (user function key F1, F2, or F3). Key F1 allows you to write to memory; key F2 retrieves the entire message; and key F3 retrieves the message a line at a time, with the space bar being used to advance the display to the next line of the message. The maximum length of the message is 13½ lines. An asterisk is typed at the end of the message when it is written to memory, which takes the computer out of the loop in all of the modes.

I hope the information in this article helps you avoid some of the problems and frustrations I've experienced. Enjoy your AIM 65. I'm having a lot of fun with mine, and I'm still learning what it's capabilities are.

#### WRITE TO MEMORY PROGRAM

JOE BURNETT  
WITH MODS BY MIKE ROWE  
APRIL 1979

0000 ORG \$0000

#### AIM SUBROUTINES

0000	CRCK	*	\$EA24	DUMP PRINT BUFFER
0000	CRLF	*	\$E9FO	CARRIAGE RETURN/LINE FEED
0000	INALL	*	\$E993	INPUT FROM ANY DEVICE
0000	OUTALL	*	\$E9BC	OUTPUT TO ANY DEVICE

#### ASCII CHARACTER

0000	SPACE	*	\$0020	SPACE CHARACTER
0000	ASTER	*	\$002A	ASTERISK CHARACTER

#### WRITE MESSAGE TO MEMORY

0000 20 F0 E9	WRITE	JSR	CRLF	CLEAR DISPLAY
0003 A0 00		LDYIM	\$00	INIT MEMORY POINTER
0005 A2 13	LINE	LDXIM	\$13	INIT CHARACTER COUNTER
0007 20 93 E9	INPUT	JSR	INALL	GET AN INPUT CHARACTER
000A 99 00 02		STAY	\$0200	STORE IN BUFFER
000D C9 2A		CMPIM	ASTER	TEST TERMINATOR
000F F0 47		BEQ	EXIT	IF YES, THEN DONE
0011 C8		INY		BUMP POINTER
0012 CA		DEX		DECR CHARACTER COUNTER
0013 D0 F2		BNE	INPUT	IF NOT ZERO, GET MORE
0015 20 24 EA		JSR	CRCK	LINE FULL, SO PRINT IT
0018 4C 05 00		JMP	LINE	GET NEXT LINE

#### READ ENTIRE MESSAGE

001B 20 F0 E9	REM	JSR	CRLF	CLEAR DISPLAY
001E A0 00		LDYIM	\$00	INIT MEMORY POINTER
0020 A2 13	RLINE	LDXIM	\$13	INIT CHARACTER COUNTER
0022 B9 00 02	RCHAR	LDAY	\$0200	GET CHARACTER FROM MEMORY
0025 C9 2A		CMPIM	ASTER	TEST FOR TERMINATOR
0027 F0 2F		BEQ	EXIT	IF YES, THEN DONE
0029 20 BC E9		JSR	OUTALL	ELSE, DISPLAY CHARACTER
002C C8		INY		BUMP MEMORY POINTER
002D CA		DEX		DECR. CHARACTER COUNTER
002E D0 F2		BNE	RCHAR	IF NOT ZERO, GET NEXT CHARACTER
0030 20 24 EA		JSR	CRCK	ELSE, PRINT LINE
0033 4C 20 00		JMP	RLINE	THEN CONTINUE

READ MESSAGE ONE LINE AT A TIME

0036 20 F0 E9	ONELIN	JSR	CRLF	CLEAR DISPLAY
0039 A0 00		LDYIM	\$00	INIT MEMORY POINTER
003B A2 13	OLINE	LDXIM	\$13	INIT CHARACTER COUNTER
003D B9 00 02	OCHAR	LDAY	\$0200	GET CHARACTER FROM MEMORY
0040 C9 2A		CMPIM	ASTER	TEST TERMINATOR
0042 F0 14		BEQ	EXIT	IF YES, THEN DONE
0044 20 BC E9		JSR	OUTALL	ELSE, PRINT CHARACTER
0047 C8		INY		BUMP MEMORY POINTER
0048 CA		DEX		DECR CHARACTER COUNTER
0049 D0 F2		BNE	OCHAR	IF NOT ZERO, CONTINUE
004B 20 93 E9	WAIT	JSR	INALL	ELSE WAIT FOR A SPACE
004E C9 20		CMPIM	SPACE	FROM KEYBOARD TO CONTINUE
0050 D0 F9		BNE	WAIT	NOT A SPACE
0052 20 24 EA		JSR	CRCK	SPACE, SO PRINT
0055 4C 3B 00		JMP	OLINE	THEN GET NEXT LINE

COMMON EXIT ROUTINE TO CLEAN UP  
THE DISPLAY AND RETURN TO MONITOR

0058 20 F0 E9	EXIT	JSR	CRLF	OUTPUT TO BLANK LINES
005B 20 F0 E9		JSR	CRLF	
005E 00		BRK		THEN EXIT TO MONITOR

USER FUNCTION DEFINITIONS

010C	ORG	\$010C	
010C 4C 00 00	JMP	WRITE	F1 TO WRITE MESSAGE
010F 4C 1B 00	JMP	REM	F2 TO READ ENTIRE MESSAGE
0112 4C 36 00	JMP	ONELIN	F3 TO READ ONE LINE AT A TIME

CKD*=0	0030 20 JSR EA24
/FF	0033 4C JMP 0020
0000 20 JSR E9F0	0036 20 JSR E9F0
0003 A0 LDY #00	0039 A0 LDY #00
0005 A2 LDX #13	003B A2 LDX #13
0007 20 JSR E993	003D B9 LDA 0200, Y
000A 99 STA 0200, Y	0040 C9 CMP #2A
000D C9 CMP #2A	0042 F0 BEQ 0058
000F F0 BEQ 0058	0044 20 JSR E9BC
0011 C8 INY	0047 C8 INY
0012 CA DEX	0048 CA DEX
0013 D0 BNE 0007	0049 D0 BNE 003D
0015 20 JSR EA24	004B 20 JSR E993
0018 4C JMP 0005	004E C9 CMP #20
001B 20 JSR E9F0	0050 D0 BNE 004B
001E A0 LDY #00	0052 20 JSR EA24
0020 A2 LDX #13	0055 4C JMP 003B
0022 B9 LDA 0200, Y	0058 20 JSR E9F0
0025 C9 CMP #2A	005B 20 JSR E9F0
0027 F0 BEQ 0058	005E 00 BRK
0029 20 JSR E9BC	
002C C8 INY	CKD*=100
002D CA DEX	/3?
002E D0 BNE 0022	010C 4C JMP 0000
	010F 4C JMP 001B
	0112 4C JMP 0036

# APPLE II® PROFESSIONAL SOFTWARE

## PIE TEXT EDITOR

PIE (PROGRAMMA IMPROVED EDITOR) is a two-dimensional cursor-based editor designed specifically for use with memory-mapped and cursor-based CRT's. It is totally different from the usual line-based editors, which were originally designed for Teletypes. The keys of the system input keyboard are assigned specific PIE Editor function commands. Some of the features included in the PIE system are: Blinking Cursor; Cursor movement up, down, right, left, plus tabs; Character insert and delete; String search forwards and backwards; Page scrolling; GOTO line number, plus top or bottom of file; Line Insert and delete anywhere on screen; Move and copy (single and multiple lines); Append and clear to end of line; Efficient memory usage. The following commands are available in the PIE Text Editor and each is executed by depressing the system's argument key simultaneously with the command key desired:

[LEFT] Move cursor one position to the left  
 [RGHT] Move cursor one position to the right  
 [UP] Move cursor up one line  
 [DOWN] Move cursor down one line  
 [BHOM] Home cursor in lower left left hand corner  
 [HOME] Home cursor in upper left hand corner  
 [-PAG] Move up (toward top of file) one "page"  
 [+PAG] Move down (toward bottom of file) one "page"  
 [LTAB] Move cursor left one horizontal tab  
 [RTAB] Move cursor right one horizontal tab  
 [GOTO] Go to top of file (line 1)  
 [ARG] n[GOTO] Go to line 'n'  
 [BOT] Go to bottom of file (last line +1)  
 [-SCH] Search backwards (up) into file for the next occurrence of the string specified in the last search command  
 [ARG] t[-SCH] Search backwards for string 't'  
 [+SCH] Search forwards (down) into the file for the next occurrence of the string specified in the last search command  
 [ARG] t[+SCH] Search forward for string 't'  
 [APP] Append -move cursor to last character of line +1  
 [INS] Insert a blank line before the current line  
 [ARG] n[INS] Insert 'n' blank lines before the current line  
 [DEL] Delete the current line, saving it in the "push" buffer  
 [ARG] n[DEL] Delete 'n' lines and save the first 20 in the "push" buffer  
 [DBLK] Delete the current line as long as it is blank  
 [PUSH] Save current line in "push" buffer  
 [ARG] n[PUSH] Save 'n' lines in the "push" buffer  
 [POP] Copy the contents of the "push" buffer before the current line  
 [CINS] Enable character insert mode  
 [CINS][CINS] Turn off character insert mode  
 [BS] Backspace  
 [GOB] Gobble - delete the current character and pull remainder of characters to right of cursor left one position  
 [EXIT] Scroll all text off the screen and exit the editor  
 [ARG] [HOME] Home Line - scroll up to move current line to top of screen  
 [APP] [APP] Left justify cursor on current line  
 [ARG] [GOB] Clear to end of line  
 Apple PIE Cassette 16K \$19.95  
 TRS-80PIE Cassette 16K 19.95  
 Apple PIE Disk 32K 24.95

## 6502FORTH • Z-80FORTH 6800 FORTH

FORTH is a unique threaded language that is ideally suited for systems and applications programming on a micro-processor system. The user may have the interactive FORTH Compiler/Interpreter system running stand-alone in 8K to 12K bytes of RAM. The system also offers a built-in incremental assembler and text editor. Since the FORTH language is vocabulary based, the user may tailor the system to resemble the needs and structure of any specific application. Programming in FORTH consists of defining new words, which draw upon the existing vocabulary, and which in turn may be used to define even more complex applications. Reverse Polish Notation and LIFO stacks are used in the FORTH system to process arithmetic expressions. Programs written in FORTH are compact and very fast.

### SYSTEM FEATURES & FACILITIES

Standard Vocabulary with 200 words  
 Incremental Assembler  
 Structured Programming Constructs  
 Text Editor  
 Block 1/0 Buffers  
 Cassette Based System  
 User Defined Stacks  
 Variable Length Stacks  
 User Defined Dictionary  
 Logical Dictionary Limit  
 Error Detection  
 Buffered Input

### CONFIGURATIONS

AppleFORTH Cassette 16K	\$34.95
AppleFORTH Disk 32K	49.95
PatFORTH Cassette 16K	34.95
TRS-80FORTH Cassette 16K	34.95
SWTPCFORTH Cassette 16K	34.95

## ASM/65 EDITOR ASSEMBLER

ASM/65 is a powerful, 2 pass disk-based assembler for the Apple II Computer System. It is a compatible subset of the FORTRAN cross-assemblers which are available for the 6500 family of micro-processor. ASM/65 features many powerful capabilities, which are under direct control of the user. The PIE Text Editor co-exists with the ASM/65 Assembler to form a comprehensive development tool for the assembler language programmer. Following are some of the features available in the ASM/65 Editor Assembler.

PIE Text Editor Command Repertoire  
 Disk Based System  
 Decimal, Hexadecimal, Octal, & Binary Constants  
 ASCII Literal Constants  
 One to Six character long symbols  
 Location counter addressing "++"  
 Addition & Subtraction Operators in Expressions  
 High-Byte Selection Operator  
 Low-Byte Selection Operator  
 Source statements of the form:  
 [label] [opcode] [operand]  
 [comment]  
 56 valid machine instruction mnemonics  
 All valid addressing modes  
 Equate Directive  
 BYTE Directive to initialize memory locations  
 WORD Directive to initialize 16-bit words  
 PAGE Directive to control source listing  
 SKIP Directive to control source listing  
 OPT Directive to set select options  
 LINK Directive to chain multiple text files  
 Comments  
 Source listing with object code and source statements  
 Sorted symbol table listing

### CONFIGURATION

Apple II	48K/Disk	\$69.95
----------	----------	---------

## LISA INTERACTIVE ASSEMBLER

LISA is a totally new concept in assembly language programming. Whereas all other assemblers use a separate or co-resident text editor to enter the assembly language program and then an assembler to assemble the source code, LISA is fully interactive and performs syntax/addressing mode checks as the source code is entered in. This is similar in operation to the Apple II Integer BASIC Interpreter. All error messages that are displayed are in plain, easy to understand English, and not simply an Error Code. Commands in LISA are structured as close as possible to those in BASIC. Commands that are included are: LIST, DELETE, INSERT, PR #n, IN #n, SAVE, LOAD, APPEND, ASM, and a special user-definable key envisioned for use with "dumb" peripherals. LISA is DISK II based and will assemble programs with a textfile too long to fit into the Apple memory. Likewise, the code generated can also be stored on the Disk, hence freeing up memory for even larger source programs. Despite these Disk features, LISA is very fast; in fact LISA is faster than most other commercially available assemblers for the Apple II. Not only is LISA faster, but also, due to code compression techniques used LISA requires less memory space for the text file. A full source listing containing the object and source code are produced by LISA, in addition to the symbol table.

Apple II 32K/Disk \$34.95

## PROGRAMMA INTERNATIONAL, INC.

3400 Wilshire Blvd.  
 Los Angeles, CA 90010

(213) 384-0579 • 384-1116 • 384-1117

Apple II is a registered trademark of Apple Computers, Inc. These professional products are available at your local computer dealer.

Software  
 Products

**S-C ASSEMBLER II**  
**Super Apple II Assembler**

Chuck Carpenter  
2228 Montclair Pl.  
Carrollton, TX 75006

I've had the good fortune to get an advance copy of an excellent assembler for the Apple II. The assembler was written by Bob Sander-Cederlof and has many desireable features. Bob has used sweet 16 and several routines from the monitor and integrar BASIC (it doesn't run with the Applesoft ROM on). The result is a compact co-resident two-pass assembler. A summary of assembler commands and data is listed in Table 1.

Here are a few of the assembler features:

- Format compatible with Apple mini-assembler
- Complete text editing using standard Apple screen and line editing features.
- Save and Load as in integrar BASIC
- Psuedo op codes
- Text for REMs following the line no.
- Tabs to the opcode, operand and comment field using (CTRL) I
- Symbol table
- Listing, fast or slow
- Stop and start a LIST or ASM at any time
- Access Apple monitor from the assembler using \$
- Run programs from the assembler

The S-C ASSEMBLER II includes many other features. Among these are:

- Line renumbering starting at 1000 by 10's
- Printer driver routine - his or yours (or mine for that matter).
- Pagination of printed output
- Program location and relocation
- Can be used to renumber BASIC programs (except branches)
- Operates within DOS (see Table 2)
- Runs on an 8K machine

I have included a couple of examples of the S-C ASSEMBLER II features in Figure 1 and 2. Figure 1 is a functional routine. Figure 2 is merely for illustration of the .DA feature. Most of the assembler capability is illustrated in Figure 1. This routine, which compares 2 byte data, can be used for many applications such as extended loop counters. The example also includes ASCII strings using the pseudo op code .AS.

A jump to the user exit at \$3F8 was used to enter the data. This also takes advantage of the (CTRL) Y feature of the Apple monitor.

By calling the print routine with PRT, a hard copy of a listing or of assembled output is obtained. The printer driver routine is output from the game paddle connector. This is a TTL level serial signal. Typing SLO(W) or FAS(T) stops the printer output. Also, SLO(W) will provide a slow listing of your program. You can stop and start the listing with the space bar and, escape back to the assembler with a (RETURN). FAS(T) cancels SLO(W) returning to normal screen speed. (See Slow List, MICRO #5 page 21.)

For text editing, you can insert a line between other lines and list any single line or combination of lines. This allows character editing or line editing using Apple ESCAPE functions ((ESCAPE)D,C,B). Also you can DEL(ETE) any line or combination of lines.

An asterisk (\*) in the first column of the label field allows that line to be a comment or blank line. Very useful for commenting a program. I used short comments in my programs; I only have 48 columns. Actually the comment can be any length (up to 100 characters or so). An asterisk used in the operand field means current location. You can add or subtract labels, hex and decimal values from the current location. Each of these can be added or subtracted, to or from, each other. Here are some examples:

```
1000 LABL LDA *-* CURRENT-CURRENT
1010 LAB2 LDA LABL-LABL
1020 LAB3 LDA *-LABL
1030 LAB4 LDA LABL+1234
1040 LAB5 LDA $1234-LABL
1050 LAB6 LDA $ABCD-5678
1060 *
1070 * EXAMPLES OF ADDITION & SUBTRACTION OF
1080 * CURRENT VALUE, LABELS, DECIMAL AND
1090 * HEX VALUES FROM EACH OTHER.
1100 *
```

Illustration of the .DA feature is shown in Figure 2. The intent here is to show data in a single or 2 byte location. Once the data value has been assigned with the .DA code, it can be manipulated with another feature. This feature is shown as a / (slant line) and # (pound) in the first column of the operand field. Here's what's happening:

LDA /LABEL = HIBYTE =  $\frac{1}{2} 256$   
LDA #LABEL = LOBYTE = MOD256

As you can see from this and the previous examples, these features provide a very powerful assembler capability.

Before I obtained this assembler I could never get very enthusiastic about extensive machine or assembly language programming. Now, with this assembler, this coding is as easy as BASIC. You can get a copy for your Apple II from:

S-C SOFTWARE  
P.O. Box 5537  
Richardson, TX 75080  
Price - \$25.00

I think you will enjoy it: having the efficiency of machine language programs developed with the ease of BASIC. The combination of compact programs with interactive capability makes personal computing even more enjoyable.

Load: \*1000.1CFFR  
 Run: \*1000G Hard Entry  
 or: \*1003G Soft Entry

**Pseudo ops:**

label .OR expr	origin (optional label)
label .EQ expr	equate
label .DA expr	data (optional label)
label .HS xxxx...x	hex string
label .AS daaaa...ad	ascii string (d is any delimiter)
.EN	end

**Commands:**

LOAD	load program from tape
SAVE	save program to tape
LIST	list entire program
LIST line#	list selected line
LIST line#,line#	list range of lines
DELETE line#	delete selected line
DELETE line#,line#	delete range of lines
RENUMBER	renumbers all lines
NEW	erase program
SLOW	program slow list
FAST	program fast list
PRT	printer driver \$1B77-1BFF
ASM	assemble program
RUN expr	execute starting at expr
APPEND	add program from tape to one in memory

Table 1  
 S-C Assembler II Summary Notes

**Instruction Steps:**

1. Bring up DOS per instruction manual
2. Reset to monitor (\*)
3. Load assembler from tape
4. Return to DOS using \$3DOC
5. BSAVE Assembler
6. LOCK Assembler
7. Call 4096 Jumps to Assembler
8. \$3DOC Jumps to DOS soft entry but...

At this point the DOS is clobbered. Any further use of DOS requires a reboot. It is very handy though to have the speed of loading the assembler from the disc.

Table 2  
 S-C Assembler II with Apple II DOS

:ASM	1000 * .IA PSEUDO OP EXAMPLE
	1010 *
	1020 .OR \$300
0300- 34 12	1030 HEX .IA \$1234
0302- 34 12	1040 DEC .IA 4660
	1050 *
	1060 * ADDRESS OF DATA
	1070 *
0304- A9 00	1080 LDA #HEX HEX LO BYTE
0306- A9 03	1090 LDA /HEX HEX HI BYTE
	1100 *
	1110 * DATA AT THE ADDRESS
	1120 *
0308- AD 02 03	1130 LDA DEC DEC LO BYTE
030B- AD 03 03	1140 LDA DEC+1 DEC HI BYTE
	1150 .EN

**SYMBOL TABLE**

HEX 0300 DEC 0302

Figure 2

DA Pseudo Op Example

```

:NEW
S-C ASSEMBLER II

:LOAD
:ASM
1000 * S-C ASSEMBLER II EXAMPLE
1010 *
1020 * COMPARES HEX VALUES
1030 * AND INDICATES WHICH
1040 * IS GREATER (OR EQUAL).
1050 *
1060 .OR $300
1070 *
1080 *.OR DEFAULT IS $0000
1090 *
1100 COUT .EQ $F1E0

0300- 58 20 30 1110 LESS .AS 'X < Y'
0303- 20 59 1120 .HS SD
0305- 8D 1130 GREQ .AS 'X >= Y'
0306- 58 20 3E 1140 .HS SD
0309- 3D 20 59 1150 XL .EQ $3C
030C- 8D 1160 XH .EQ $3D
1170 YL .EQ $3E
1180 YH .EQ $3F
030D- A5 3C 1190 STAR LDA XL
030F- C5 3E 1200 CMP YL
0311- A5 3D 1210 LDA XH
0313- E5 3F 1220 SBC YH
0315- B0 06 1230 BCS TST1 X >= Y
0317- A0 00 1240 LDY #LESS-LESS
0319- 20 28 03 1250 JSR PRNT
031C- 60 1260 RTS
031D- A0 06 1270 TST1 LDY #GREQ-LESS
031F- 40 28 03 1280 JMP PRNT
0322- 09 80 1290 PRT1 ORA #$80 NORMAL OUT
0324- 20 E0 FI 1300 JSR COUT
0327- 08 1310 INY
0328- B9 00 03 1320 PRNT LDA LESS,Y
032B- 10 F5 1330 BPL PRT1
032D- 40 E0 FI 1340 JMP COUT
1350 *
1360 * DATA ENTRY THROUGH
1370 * USER EXIT @ $3F8.
1380 *
1390 * DATA.DATA (CTRL)Y
1400 *
1410 .OR $3F8 :
03F8- 4C 00 03 1420 JMP STAR :EXAMPLE RUN
1430 .EN :$10000.20000
X >= Y

```

#### SYMBOL TABLE

COUT	F1E0	LESS	0300	GREQ	0306	X >= Y
XL	003C	XH	003D	YL	003E	
YH	003F	STAR	030D	TST1	031D	#3.3
PRT1	0322	PRNT	0328			X >= Y

Figure 1  
S-C Assembler II Example

# softside software

305 Riverside Drive, New York, N.Y. 10025  
212-866-8058

## the pet program.

### 1 GRAPHICS PAC

Quadruple your PET's graphic resolution. Do not be stuck with the PET's cumbersome 25X40 1000 point display. With the Graphics Pac you can *individually control 4000 points* on screen. It's great for *graphing, plotting, and gaming*. The Pac is a set of three programs with full documentation. PLOT places coordinate 0,0 in the screen's upper left hand corner. For more sophisticated applications the Pac includes GRAPH which plots point 0,0, in the center of the screen allowing you to *plot equations in all four quadrants*. As a bonus a Hi Res Doodle game is included. All this on a high quality cassette for \$9.95.

### 2 ASSEMBLER 2001

is a full featured assembler for your PET microcomputer that follows the standard 6502 set of machine language mnemonics. Now you can write machine code programs. Store your assembled programs, load them, run them, and even list your programs and various PET subroutines. Unlike other assemblers this is one program! You do not have to go through a three tape process to edit and run a program. Of course to make more space you can trim out the features you do not need. Assembler 2001 allows you to run through the USR of SYS commands. This valuable program is offered at \$15.95.

### 3 BIKE

An exciting new simulation that puts you in charge of a bicycle manufacturing empire. Juggle inflation, breakdowns, seasonal sales variations, inventory, workers, prices, machines, and ad campaigns to keep your enterprise in the black. Bike is dangerously addictive. Once you start a game you will not want to stop. To allow you to take short rest breaks, Bike lets you store the data from your game on a tape so you can continue where you left off next time you wish to play. Worth a million in fun, we'll offer BIKE at \$9.95.

### 4 PINBALL

Dynamic usage of the PET's graphics features when combined with the fun of the number 1 arcade game equals an action packed video spectacle for your computer. Bumpers, chutes, flippers, free balls, gates, a jackpot, and a little luck guarantee a great game for all. \$9.95.

### 5 SUPER DOODLE

Give your PET a workout. This program really puts the PET's graphics to work. Super Doodle lets you use the screen of your PET like a sketch pad. Move a cursor in eight directions leaving a trail of any of the 256 characters the PET can produce. New features include an erase key that automatically remembers your last five moves, a return to center key, and clear control. Why waste any more paper, buy Super Doodle for only \$9.95.

### 6 DRIVING ACE

Non stop excitement with a fast moving, high paced version of your favorite video arcade racing games. Shift up! Shift Down! Watch your gas, and be careful on those hairpin turns. This dynamite tape has the two most common arcade racing games specially adapted to run on your PET computer. Driving Ace simulates an endless road packed with tight turns and gentle, but teasing, twists. Starting with fifty gallons of gas, how far can you go with a minimum of accidents? Grand Prix places you and your car on a crowded racing track. Race the clock and be careful steering around the fast but packed Grand Prix track. \$9.95

Dealer Rates On Request

## A PET HEX DUMP PROGRAM

Joseph Donate  
193 Walford Rd. E.  
Sudbury, ONT., Canada

Have you PET owners ever wondered how it could be possible to look at your BASIC which resides in Read Only Memory (ROM)? To be able to look for routines entry points and other interesting codes in machine language?

This program will do just that. You can look at all memory locations in PET's BASIC which starts at 49152 decimal or COOO hexadecimal in memory. One is able for example to look at locations D71E through D890 where addition and subtraction routines are carried out, D8BF through D8FC where the log function is evaluated, D9E1 through DA73 where division is performed and many other locations where other routines are carried out.

A start for this program was provided by Mr. Herman's article of MICRO 7:47. Of course the same information was available in the Commodore Users Notes.

In any event I decided that the ultimate goal of the program would be to provide a memory dump of some sort in hexadecimal notation so that machine language instructions could easily be recognized.

The output of the program is formatted as a starting address followed by either 32 or 8 bytes of data per line, all in hexadecimal, depending on whether or not a printer is to be used. With the data bytes in hex notation it is very easy to correlate them with the 6502 microprocessor machine language instruction set.

The program listing has been thoroughly debugged and tested. Although the program was originally written for a PET with a Centronics printer, as I outlined in the REM's, the program will run on a "bare" PET with no problem.

```
1 REM *** A BASIC PET HEX DUMP ***
2 REM THIS PROGRAM WILL PEEK AT PET'S
3 REM MEMORY IN ROM STARTING AT A GIVEN ADDRESS 'K' (49152 DECIMAL) AND RETURN
4 REM THE CORRESPONDING DATA. ALL VALUES ARE CONVERTED TO HEXADECIMAL PRIOR TO
5 REM PRINTING. THE FORMAT IS: STARTING ADDRESS PLUS 32 OR 8 BYTES OF DATA,
6 REM PER LINE DEPENDING WHETHER OR NOT A PRINTER IS USED.
7 REM
8 REM THE COMMAND ON LINE 10 INITIALIZES THE PRINTER PORT. IT *MUST* BE OMITTED
9 REM IF A "BARE" PET IS USED.
10 OPEN 5,5:CMD 5
11 REM FOLLOWING IS A MACHINE LANGUAGE
12 REM ROUTINE WHICH RESIDES IN NUMBER 2 TAPE
13 REM BUFFER AREA. IT RETURNS THE CONTENTS OF THE CORRESPONDING MEMORY
14 REM LOCATIONS SPECIFIED BY 'K'.
15 POKE(1),58
16 POKE(2),3
17 POKE(826),32
20 POKE(827),167
30 POKE(828),208
40 POKE(829),166
```

The changes for a "bare" PET are as follows:

1. Omit line 10.
2. Change line 542 to read:  
542 IF L<9 THEN 570
3. Omit all print statements and substitute instead the print format outlined in the REM's at lines 606 through 612. These print lines are to be placed at line 545, 546, 547, 548.
4. Notice that there is no comma or semicolon after the last print character. This is very important otherwise the format will be destroyed.

A considerable amount of time was spent on both versions of the program. No problems were encountered in running either version.

I hope that by following the machine language coding of the 6502 some of you will obtain a better understanding of PET's Basic 'inner workings'. Also some of you who have the T.I.M. monitor will be able to trace its subroutines and jumps to Basic. Perhaps it may inspire you in writing some machine language programs or routines.

I should add that if one wishes to look at different addresses other than the COOO (49152 decimal), all you need do is to change the starting address value "K" in line 240. This must be in decimal notation

I hope you get as much pleasure as I did 'sneaking a look' at PET's Basic.

```

50 POKE(830),179
60 POKE(831),164
70 POKE(832),180
80 POKE(833),134
90 POKE(834),180
100 POKE(835),132
120 POKE(836),179
130 POKE(837),162
140 POKE(838),00
150 POKE(839),161
160 POKE(840),179
170 POKE(841),168
180 POKE(842),169
190 POKE(843),00
200 POKE(844),32
210 POKE(845),120
220 POKE(846),210
230 POKE(847),96
232 REM SET UP STORAGE AREA FOR ONE
233 REM LINE OF HEX VALUES TO BE PRINTED
235 DIM N1$(40),NO$(40)
236 REM INITIALIZE CHARACTER COUNTER
237 L=1
238 REM THE VALUE OF 'K' DETERMINES
239 REM THE STARTING ADDRESS.
240 FOR K=49152 TO 65536
241 I=K
250 A=USR(K-65536)
255 REM LINES 270-530 CONSIST OF A SUBROUTINE TO CONVERT ALL VALUES FROM
256 REM DECIMAL TO HEXADECIMAL NOTATION
270 B%=16
280 D=A
390 H$="0123456789ABCDEF"
400 NO$(L)=""
405 N1$(L)=""
410 F%=LOG(I)/LOG(B%)
411 REM BECAUSE THE DECIMAL TO HEX ROUTINE
412 REM RETURNS A SINGLE '0' FOR VALUES
413 REM OF A=0, LINE 416 CONVERTS
414 REM ANY OF THESE ZERO VALUES TO
415 REM A DOUBLE HEX '00'.
416 IF A=0 THEN NO$(L)="00":GOTO 480
418 G%=LOG(D)/LOG(B%)
420 FOR J=G% TO 0 STEP -1
430 X=INT(B%^J)
440 C%=D/X
445 REM LINE 455 INSERTS A LEADING ZERO
446 REM IN HEXADECIMAL VALUES OF LESS
447 REM THAN 'F'(15). EX. '7'='07' ETC.
450 NO$(L)=NO$(L)+MID$(H$,C%+1,1)
455 IF A<16 THEN NO$(L)=('0'+NO$(L))
460 D=INT(D-C%*X)
470 NEXT J
480 FOR J=F% TO 0 STEP -1
490 X=INT(B%^J)
500 C%=INT(I/X)
510 N1$(L)=N1$(L)+MID$(H$,C%+1,1)
520 I=INT(I-C%*X)
530 NEXT J

```

532 REM SUBROUTINE FOR DECIMAL TO HEXADECIMAL CONVERSION ENDS HERE  
 535 L=L+1  
 536 REM LINE 542 CHECKS TO SEE IF THE  
 537 REM REQUIRED NUMBER OF CHARACTERS  
 538 PER LINE HAVE BEEN DONE. THE TEST VALUE  
 539 NUMBER 33 \*MUST\* BE CHANGED TO A NUMBER 9 IF A "BARE" PET IS USED.  
 542 IF L<>33 THEN 570  
 545 PRINT N1\$(1)," ",NO\$(1)," ",NO\$(2)," ",NO\$(3)," ",NO\$(4)," ",NO\$(5),  
 546 PRINT " ",NO\$(6)," ",NO\$(7)," ",NO\$(8)," ",NO\$(9)," ",NO\$(10)," ",  
 547 PRINT NO\$(11)," ",NO\$(12)," ",NO\$(13)," ",NO\$(14)," ",NO\$(15)," ",  
 548 PRINT NO\$(16)," ",NO\$(17)," ",NO\$(18)," ",NO\$(19)," ",NO\$(20)," ",  
 549 PRINT NO\$(21)," ",NO\$(22)," ",NO\$(23)," ",NO\$(24)," ",NO\$(25)," ",  
 550 PRINT NO\$(26)," ",NO\$(27)," ",NO\$(28)," ",NO\$(29)," ",NO\$(30)," ",  
 560 PRINT NO\$(31)," ",NO\$(32)

565 L=1

570 NEXT K

600 REM THE PRINT STATEMENT FOR THE PET

602 REM WITH NO PRINTER "BARE" SHOULD BE AS FOLLOWS:

606 REM PRINT N1\$(1);";NO\$(1);";  
 608 REM NO\$(2);";NO\$(3);";NO\$(4);  
 610 REM " ";NO\$(5);";NO\$(6);";  
 612 REM NO\$(7);";NO\$(8);";NO\$(9)  
 615 END

C000	1D	C7	48	06	35	00	EF	C7	C5	0A	0F	0A	70	0F	23	08	90	08	90	C7	74	07	1F	08	00	C7	7F	07	C9	07	32	08
C008	1B	C7	42	08	01	D7	D4	FF	D7	FF	0A	FF	94	D2	F8	D6	7E	C9	9E	C9	44	C7	R7	C5	6F	C7	94	C9	D0	FF	BF	FF
C040	C2	FF	9E	0A	3B	C5	98	D8	9E	D8	2A	D8	98	64	D2	05	D2	24	DE	45	DF	BF	D8	98	DE	9E	DF	R5	DF	EE	DF	
C060	48	E8	E6	D6	54	D6	49	D3	85	D6	63	D6	C4	D5	D8	D5	04	D6	0F	D6	79	3E	D7	79	27	D7	78	FF	D8	78	E3	D9
C080	7F	2D	DE	58	D8	CE	46	D5	CE	7D	66	DE	5A	E7	CD	64	85	CF	45	4E	C4	46	4F	D2	4E	45	58	04	44	41	54	C1
C098	49	4E	58	55	54	R3	49	4E	58	55	04	44	49	CD	52	45	41	C4	4C	45	04	47	4F	54	07	52	55	CE	49	06	52	45
C0C0	53	54	4F	52	C5	47	4F	53	55	C2	52	45	54	55	52	CE	52	45	CD	53	54	4F	D6	4F	CE	57	41	49	04	4C	4F	41
C0E0	C4	53	41	56	C5	56	45	52	49	46	D9	44	45	C5	58	4F	4B	C5	58	52	49	4E	54	R3	50	52	49	4E	D4	43	4F	4E
C100	D4	4C	49	53	D4	43	4C	D2	43	40	C4	53	59	D2	4F	58	45	CE	43	4C	4F	53	C5	47	45	D4	4E	45	D7	54	41	42
C120	R8	54	CF	46	CE	53	58	43	R8	54	48	45	CE	4E	4F	D4	53	54	45	D8	R8	R0	R8	RF	DE	41	4E	04	4F	D2	BE	B0
C140	5C	53	47	CE	49	4E	04	41	42	D3	55	53	D2	46	52	C5	59	4F	D3	53	51	D2	52	4E	C4	4C	4F	C7	45	58	08	43
C160	4F	D3	53	49	CE	54	41	CE	41	54	CE	58	45	45	C8	4C	45	CE	53	54	52	R4	56	41	CC	41	53	C3	43	48	52	R4
C180	4C	45	46	54	R4	52	49	47	48	54	R4	40	49	44	R4	00	4E	45	58	54	28	57	49	54	48	4F	55	54	28	46	4F	D2
C1A0	53	59	4E	54	41	D8	52	45	54	55	52	4E	28	57	49	54	48	4F	55	54	20	47	4F	53	55	02	4F	55	54	28	4F	46
C1C0	28	44	41	54	C1	49	4C	40	45	47	41	4C	20	51	55	41	4E	54	49	54	D9	08	08	08	08	4F	56	45	52	46	4C	
C1E0	4F	D7	4F	55	54	28	4F	46	28	40	45	40	47	52	09	55	4E	44	45	46	27	44	28	53	54	41	54	43	40	45	4E	D4
C200	42	41	44	28	53	55	42	53	43	52	49	58	04	52	45	44	49	40	27	44	28	41	52	52	41	D9	44	49	56	49	53	49
C220	4F	4E	28	42	59	28	58	45	52	CF	49	4C	40	45	47	41	4C	28	44	49	52	45	43	D4	54	59	58	45	28	40	49	53
C240	4D	41	54	43	C3	53	54	52	49	4E	47	28	54	4F	4F	20	4C	4F	4E	C7	42	41	44	28	44	41	54	C1	46	4F	52	40
C260	55	40	41	28	54	4F	4F	28	43	4F	40	58	40	45	D8	43	41	4E	27	54	28	43	4F	4E	54	49	4E	55	C5	55	4E	44
C280	45	46	27	44	28	46	55	4E	43	54	49	4F	CE	28	45	52	52	4F	52	00	28	49	4E	28	00	00	00	52	45	41	44	59
C2A0	2E	80	08	08	80	08	42	52	45	41	45	08	88	E8	E8	E8	E8	80	01	C9	81	D6	21	R5	99	D8	08	BD	02	81	85	
C2C0	98	80	03	01	85	99	00	03	01	D8	07	A5	98	D0	02	01	F0	07	88	18	69	12	AB	D8	08	68	28	2A	C3	85	88	84
C2E0	81	38	85	R9	E5	RE	85	74	R8	85	R9	E5	RF	R9	E8	98	FB	23	45	99	38	E5	71	85	R9	88	83	C6	AB	38	R5	R7
C300	E5	71	65	R7	B8	08	C6	R8	98	R4	B1	R9	91	R7	88	D8	F9	B1	R9	91	R7	C6	AB	C8	D8	F2	68	88	69	36		
C320	B8	35	85	71	B8	E4	71	98	2E	68	C4	83	98	28	D8	04	C5	82	98	22	48	A2	89	98	48	85	A6	CA	10	FA	28	84
C340	D4	A2	F7	68	95	B8	E8	38	FR	68	R8	68	C4	83	98	06	D8	05	C5	82	88	01	68	R2	52	46	64	R5	03	F8	87	28
C360	CC	FF	R9	08	85	03	20	D2	C9	28	47	CA	B0	98	C1	48	29	7F	20	49	CA	E8	68	10	F3	28	84	C5	R9	80	R8	C2
C380	28	27	CR	A4	89	C8	F0	03	28	94	DC	46	64	R9	99	R8	C2	20	27	CA	28	68	C4	86	C9	84	CR	28	C2	08	F0	F4
C3A0	R2	FF	86	89	90	06	20	80	C4	4C	E9	05	20	63	C8	28	80	C4	84	5C	20	22	C5	98	44	R8	01	B1	RE	85	72	R5

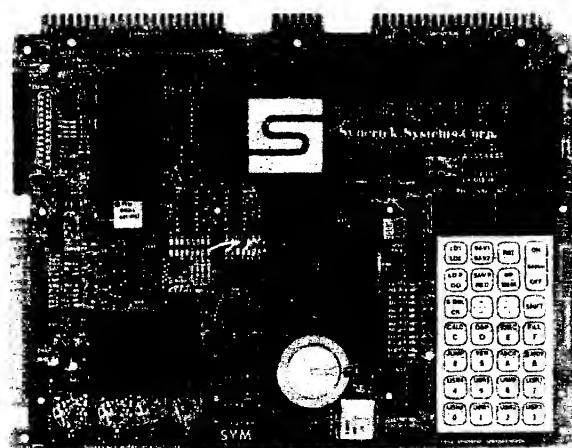
BREAK IN 240

READY.

Example of a partial Hex Dump obtained with the Program

## SYM-1, 6502-BASED MICROCOMPUTER

- FULLY-ASSEMBLED AND COMPLETELY INTEGRATED SYSTEM that's ready-to-use
- ALL LSI IC'S ARE IN SOCKETS
- 28 DOUBLE-FUNCTION KEYPAD INCLUDING UP TO 24 "SPECIAL" FUNCTIONS
- EASY-TO-VIEW 6-DIGIT HEX LED DISPLAY
- KIM-1\* HARDWARE COMPATIBILITY
- The powerful 6502 8-Bit MICROPROCESSOR whose advanced architectural features have made it one of the largest selling "micras" on the market today.
- THREE ON-BOARD PROGRAMMABLE INTERVAL TIMERS available to the user, expandable to five on-board.
- 4K BYTE ROM RESIDENT MONITOR and Operating Programs.
- Single 5 Volt power supply is all that is required.
- 1K BYTES OF 2114 STATIC RAM onboard with sockets provided for immediate expansion to 4K bytes onboard, with total memory expansion to 65, 536 bytes.
- USER PROM/ROM: The system is equipped with 3 PROM/ROM expansion sockets for 2316/2322 ROMs or 2716 EPROMs
- ENHANCED SOFTWARE with simplified user interface
- STANDARD INTERFACES INCLUDE:
  - Audia Cassette Recorder Interface with Remote Control (Two modes: 135 Baud KIM-1\* compatible, Hi-Speed 1500 Baud)
  - Full duplex 20mA Teletype Interface
  - System Expansion Bus Interface
  - TV Controller Board Interface
  - CRT Compatible Interface (RS-232)
- APPLICATION PORT: 15 Bi-directional TTL Lines for user applications with expansion capability for added lines
- EXPANSION PORT FOR ADD-ON MODULES (51 I/O Lines included in the basic system)
- SEPARATE POWER SUPPLY connects for easy disconnect of the d-c power
- AUDIBLE RESPONSE KEYPAD



Synertek has enhanced KIM-1\* software as well as the hardware. The software has simplified the user interface. The basic SYM-1 system is programmed in machine language. Monitor status is easily accessible, and the monitor gives the keypad user the same full functional capability of the TTY user. The SYM-1 has everything the KIM-1\* has to offer, plus so much more that we cannot begin to tell you here. So, if you want to know more, the SYM-1 User Manual is available, separately.

<b>SYM-1 Complete w/manuals</b>	<b>\$269.00</b>
<b>SYM-1 User Manual Only</b>	<b>7.00</b>
<b>SYM-1 Expansion Kit</b>	<b>75.00</b>

Expansion includes 3K of 2114 RAM chips and 1-6522 I/O chip.

**SYM-1 Manuals:** The well organized documentation package is complete and easy-to-understand.

**SYM-1 CAN GROW AS YOU GROW.** Its the system to BUILD-ON. Expansion features that are soon to be offered:

<b>*BAS-1 8K Basic ROM (Microsoft)</b>	<b>\$159.00</b>
<b>*KTM-2 TV Interface Board</b>	<b>349.00</b>

\*We do honor Synertek discount coupons

## QUALITY EXPANSION BOARDS DESIGNED SPECIFICALLY FOR KIM-1, SYM-1 & AIM 65

These boards are set up for use with a regulated power supply such as the one below, but provisions have been made so that you can add onboard regulators for use with an unregulated power supply. But, because of unreliability, we do not recommend the use of onboard regulators. All I.C.'s are socketed for ease of maintenance. All boards carry full 90-day warranty.

All products that we manufacture are designed to meet or exceed industrial standards. All components are first quality and meet full manufacturer's specifications. All this and an extended burn-in is done to reduce the normal percentage of field failures by up to 75%. To you, this means the chance of inconvenience and lost time due to a failure is very rare; but, if it should happen, we guarantee a turn-around time of less than forty-eight hours for repair.

**Our money back guarantee:** If, for any reason you wish to return any board that you have purchased directly from us within ten (10) days after receipt, complete, in original condition, and in original shipping carton; we will give you a complete credit or refund less a \$10.00 restocking charge per board.

### VAK-1 8-SLOT MOTHERBOARD

This motherboard uses the KIM-4\* bus structure. It provides eight (8) expansion board sockets with rigid card cage. Separate jacks for audio cassette, TTY and power supply are provided. Fully buffered bus.

**VAK-1 Motherboard** **\$129.00**

### VAK-2/4 16K STATIC RAM BOARD

This board using 2114 RAMs is configured in two (2) separately addressable 8K blocks with individual write-protect switches.

**VAK-2 16K RAM Board with only 8K of RAM (½ populated)** **\$239.00**

**VAK-3 Complete set of chips to expand above board to 16K** **\$175.00**

**VAK-4 Fully populated 16K RAM** **\$379.00**

### VAK-5 2708 EPROM PROGRAMMER

This board requires a +5 VDC and +12 VDC, but has a DC to DC

multiplier so there is no need for an additional power supply. All software is resident in on-board ROM, and has a zero-insertion socket.

**VAK-5 2708 EPROM Programmer** **\$269.00**

### VAK-6 EPROM BOARD

This board will hold 8K of 2708 or 2758, or 16K of 2716 or 2516 EPROMs. EPROMs not included.

**VAK-6 EPROM Board** **\$129.00**

### VAK-7 COMPLETE FLOPPY-DISK SYSTEM (May '79)

### VAK-8 PROTOTYPING BOARD

This board allows you to create your own interfaces to plug into the motherboard. Etched circuitry is provided for regulators, address and data bus drivers; with a large area for either wire-wrapped or soldered IC circuitry.

**VAK-8 Prototyping Board** **\$49.00**

## POWER SUPPLIES

ALL POWER SUPPLIES are totally enclosed with grounded enclosures for safety, AC power cord, and carry a full 2-year warranty.

### FULL SYSTEM POWER SUPPLY

This power supply will handle a microcomputer and up to 65K of our VAK-4 RAM. ADDITIONAL FEATURES ARE: Over voltage Protection at 5 volts, fused, AC on/off switch. Equivalent to units selling for \$225.00 or more.

**Provides +5 VDC @ 10 Amps & ±12 VDC @ 1 Amp**

**VAK-EPS Power Supply** **\$125.00**

\*KIM is a product of MOS Technology

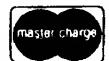
**KIM-1\* Custom P.S. provides 5 VDC @ 1.2 Amps and +12 VDC @ .1 Amps**

**KCP-1 Power Supply** **\$41.50**

**SYM-1 Custom P.S. provides 5 VDC @ 1.4 Amps**

**VCP-1 Power Supply** **\$41.50**

2967 W. Fairmount Avenue  
Phoenix AZ 85017  
(602)265-7564



**RNB ENTERPRISES**  
INCORPORATED

## SUPER HI-LO FOR THE SYM-1

Jack Cieryic  
2041 138th Ave. N.W.  
Andover, MN 55303

Super Hi-Lo has a new twist to the game. This program fits into the standard 1K SYM and execution begins at location 200. The left two LED digits are your upper limit (initialized to 99) and the middle two digits are your lower limit (initialized to 00). SYM picks a random number and you attempt to guess it. Your attempt count is seen in the right two digits. The right digit will blink when it's your last guess.

After entering the command GO 200 CR press any key to start the contest. Enter your two digit guess (decimal only) and hit the "A" key. Win or loose you get an appropriate message at the end after which the LED's go blank. Hit any key and you are ready for a second game. If you didn't guess the number then you will be given one more chance in the next game. If you are lucky enough to guess the number then you will have one less chance the next game.

For you SYMMERS who are interested in taking things one step further, you will find MESSAG an interesting subroutine you may want to incorporate in your own programs. This code is entirely

relocatable except for the first four instructions which must be calculated if the code is moved. The routine uses page zero locations OD, OE, OF and 10, but you can change that too if necessary. The A and X registers contain the message buffer address per comments in the program. This message buffer contains segment codes which will light up any combination of LED segments.

Refer to Figure 4-6 Keyboard/Display Schematic in your reference manual for the LED segments in the lower right corner. Segment "a" is turned on by setting bit 0 to a one in a message buffer entry. Segment "b" is controlled by bit 1 and so on with segments c, d, e, f, g and the decimal point. Thus a hex 5C is a lower case O (segments c, d, e, and g). Feel free to change either message but don't forget to add a few OO characters at the start and end of your message. If you relocate the message buffer then change the register parameters prior to the call to MESSAG.

One other note on the program. By changing the value at location 206 you can alter the rate at which the right LED will blink when you reach your last chance.

## NOW AVAILABLE

For SOL-IIA and PET-8K

## Basic Software

### General Pack 1

(Checkbook Balancer, Tic Tac Toe, Metric Conversion)

\$10.95

### General Pack 2

(Space Patrol, Biorhythm, Battlestar, One-Armed Bandit)

18.95

### Financial Pack 1

(Loans, Depreciation, Investments)

12.95

### Financial Pack 2

(Mortgage & Loan Amortization, Future Projections, Risk Analysis)

12.95

### Statistics Pack 1

(Mean & Deviation, Linear Correlations & Regression, Distribution, Contingency Table Analysis)

18.95

### Game Pack 1

(Basketball, Object Removal, Bowling, Darts, Gopher)

22.95

### Game Pack 2 -

(children - educational) 12.95

(Arithmetic God, Addition Dice, Distance = Rate X Time)

### Tape Data Query

(File Management System) 50.00

### PCROS - a Real-Time Operating System in 1K KIM RAM

Assembly listing 24.95

Cassette tape with user's manual 14.95  
Schematic for relay control board 9.95

All programs on high-quality cassette tape.

Send self-address, stamped envelope for complete software catalogue.

Send check or money order to:

H. GELLER COMPUTER SYSTEMS

Dept. M

P.O. Box 350

New York, New York 10040

(New York residents add applicable sales tax)

SYM SUPER HI-LO  
JOHN GIERYIC  
APRIL 1979

SYM REFERENCES

035E	KYSTAT *	\$896A
035E	ACCESS *	\$8B86
035E	OUTBYT *	\$82FA
035E	SCAND *	\$8906
035E	KEYO *	\$8923
035E	GETKEY *	\$88AF
035E	ASCNIB *	\$8275
035E	DISBUF *	\$A640
035E	RDIG *	\$A645

MESSAGE POINTERS

035E	MFAIL *	\$0360
035E	MSUCC *	\$0380

0000 ORG \$0000

0000 00	UPP	=	\$00	UPPER NUMBER
0001 00	LOW	=	\$00	LOWER NUMBER
0002 00	ACNT	=	\$00	ATTEMPT COUNT
0003 00	RAN	=	\$00	RANDOM NUMBER 2 - 98
0004 00	TEMP	=	\$00	
0005 00	UGES	=	\$00	GUESS UNITS
0006 00	TGES	=	\$00	GUESS TENS
0007 00	BLINK	=	\$00	BLINK FLAG 1 = BLINK
0008 00	TDIG	=	\$00	SAVE RDIG
0009 00	DARK	=	\$00	1 = DARK
000A 00	LATT	=	\$00	ATTEMPT LIMIT
000B 00	ONOFF	=	\$00	BLINKING
000C 00	BLIM	=	\$00	BLINKING LOOP COUNT INIT.
000D 00	COUNT	=	\$00	
000E 00	LOOPA	=	\$00	
000F 00	LOOPB	=	\$00	
0010 00	CLIM	=	\$00	MESSAGE LIMIT

0200 ORG \$0200 PROGRAM ORIGIN

0200 20 86 8B	BEGIN	JSR	ACCESS	
0203 A9 60		LDAIM	\$60	INIT BLINKING LOOP LIMIT
0205 85 0C		STA	BLIM	
0207 A9 06		LDAIM	\$06	INIT ATTEMPT COUNTER
0209 85 0A		STA	LATT	

020B A9 63	TILL	LDAIM	\$63	INIT UPPER LIMIT
020D 85 00		STA	UPP	
020F A9 00		LDAIM	\$00	INIT BLINK FLAG
0211 85 07		STA	BLINK	
0213 85 01		STA	LOW	LOWER LIMIT
0215 85 02		STA	ACNT	ATTEMPT COUNT
0217 A9 01		LDAIM	\$01	

0219 85 03		STA	RAN	RANDOM NUMBER
021B E6 03	INCRAN	INC	RAN	INCREMENT RANDOM NUMBER
021D A5 03		LDA	RAN	
021F C9 63		CMPIM	\$63	IF EQUAL 99 DECIMAL
0221 D0 04		BNE	KEYIN	
0223 A9 02		LDAIM	\$02	THEN RESET TO 2
0225 85 03		STA	RAN	
0227 20 6A 89	KEYIN	JSR	KYSTAT	IS A KEY DOWN?
022A 90 EF		BCC	INCRAN	LOOP UNTIL ONE IS DOWN
022C A5 00	LIMITS	LDA	UPP	PUT UPPER, LOWER AND
022E 20 00 03		JSR	HTDEC	ATTEMPT COUNT IN
0231 20 FA 82		JSR	OUTBYT	DISPLAY BUFFER
0234 A5 01		LDA	LOW	
0236 20 00 03		JSR	HTDEC	
0239 20 FA 82		JSR	OUTBYT	
023C A5 02		LDA	ACNT	
023E 20 00 03		JSR	HTDEC	
0241 20 FA 82		JSR	OUTBYT	
0244 20 06 89	DISP	JSR	SCAND	LIGHT LED
0247 20 23 89		JSR	KEYQ	IF KEY IS DOWN,
024A D0 30		BNE	READK	
024C A5 07		LDA	BLINK	IF BLINKING IS REQUESTED
024E C9 01		CMPIM	\$01	
0250 D0 F2		BNE	DISP	
0252 A5 0B		LDA	ONOFF	IF TIME TO TURN CHARACTER ON
0254 D0 21		BNE	INCLOP	
0256 A5 09		LDA	DARK	IF TURN CHAR. OFF
0258 C9 01		CMPIM	\$01	
025A D0 0E		BNE	RIGHT	
025C AD 45 A6		LDA	RDIG	THEN GET CHARACTER
025F 85 08		STA	TDIG	SAVE IT
0261 A9 00		LDAIM	\$00	SET RIGHT DIGIT BLANK
0263 8D 45 A6		STA	RDIG	
0266 C6 09		DEC	DARK	SWITCH FLAG
0268 F0 07		BEQ	LCOUNT	
026A A5 08	RIGHT	LDA	TDIG	ELSE RESTORE RIGHT DIGIT
026C 8D 45 A6		STA	RDIG	
026F E6 09		INC	DARK	SWITCH FLAG
0271 A5 0C	LCOUNT	LDA	BLIM	RESET LOOP COUNTER
0273 85 0B		STA	ONOFF	
0275 D0 CD		BNE	DISP	
0277 E6 0B	INCLOP	INC	ONOFF	INCR. LOOP COUNTER
0279 4C 44 02		JMP	DISP	LOOP
027C 20 AF 88	READK	JSR	GETKEY	GET DEPRESSED KEY
027F 20 75 82		JSR	ASCNIB	
0282 C9 0A		CMPIM	\$0A	IS IT "A" (ATTEMPT)
0284 F0 0B		BEQ	SETLOP	YES
0286 AA		TAX		NO
0287 A5 05		LDA	UGES	MOVE PREVIOUS KEY
0289 85 06		STA	TGES	TO TENS DIGIT
028B 8A		TXA		
028C 85 05		STA	UGES	PUT NEW KEY INTO UNITS

028E 4C 44 02	JMP	DISP	LOOP
0291 A6 06	SETLOP	LDX	TGES SET LOOP INDEX (TENS)
0293 A9 00		LDAIM	\$00 INIT A REGISTER
0295 18		CLC	CLEAR CARRY FALG
0296 CA	DECX	DEX	DECR. X REG.
0297 30 04		BMI	ADUNIT IF NEG, THEN FINISHED
0299 69 0A		ADCIM	\$0A ELSE ADD 10
029B D0 F9		BNE	DECX LOOP
029D 65 05	ADUNIT	ADC	UGES ADD UNITS VALUE
029F C5 03		CMP	RAN COMPARE TO RANDOM
02A1 D0 03		BNE	ADUP
02A3 4C E4 02		JMP	SUCCEED GUESS = RANDOM
02A6 90 09	ADUP	BCC	TLOW
02A8 C5 00		CMP	UPP
02AA B0 0B		BCS	INCA
02AC 85 00	RUP	STA	UPP REPLACE UPPER WITH GUESS
02AE 4C B7 02		JMP	INCA
02B1 C5 01	TLOW	CMP	LOW
02B3 90 02		BCC	INCA
02B5 85 01		STA	LOW REPLACE LOWER WITH GUESS
02B7 E6 02	INCA	INC	ACNT INCR. ATTEMPT COUNT
02B9 A5 02		LDA	ACNT LIMIT REACHED?
02BB C5 0A		CMP	LATT
02BD D0 03		BNE	TEST NO
02BF 4C D8 02		JMP	FAIL YES = FAILURE
02C2 38	TEST	SEC	
02C3 A5 0A		LDA	LATT LAST ATTEMPT COMING UP
02C5 E5 02		SBC	ACNT
02C7 C9 01		CMPIM	\$01
02C9 D0 0A		BNE	WAIT NO
02CB E6 07		INC	BLINK YES - INIT FOR BLINKING
02CD A5 0C		LDA	BLIM
02CF 85 0B		STA	ONOFF
02D1 A9 01		LDAIM	\$01
02D3 85 09		STA	DARK
02D5 4C 2C 02	WAIT	JMP	LIMITS GO WAIT FOR NEXT ATTEMPT
02D8 E6 0A	FAIL	INC	LATT FAILURE = INCR ATTEMPT LIMIT
02DA A2 03		LDXIM	MFAIL / MESSAGE HI BYTE
02DC A9 60		LDAIM	MFAIL MESSAGE LO BYTE
02DE 20 17 03		JSR	MESSAG DISPLAY FAILURE MESSAGE
02E1 4C 0B C2		JMP	TILL RESTART HI-LO
02E4 C6 0A	SUCCEED	DEC	LATT SUCCESS = DECR ATTEMPT LIMIT
02E6 A2 03		LDXIM	MSUCC / MESSAGE HI BYTE
02E8 A9 80		LDAIM	MSUCC MESSAGE LO BYTE
02EA 20 17 03		JSR	MESSAG DISPLAY SUCCESS MESSAGE
02ED 4C 0B 02		JMP	TILL RESTART HI-LO

#### SUBROUTINE HTDEC

ENTRY JSR HTDEC

THIS ROUTINE WILL CONVERT A HEX NUMBER TO DECIMAL. UPON ENTRY THE A REGISTER CONTAINS THE NUMBER TO CONVERT. UPON EXIT THE A REG. CONTAINS THE UNITS DIGIT AND THE X REGISTER CONTAINS THE TENS DIGIT.

0300	ORG	\$0300	
0300 A2 00	HTDEC	LDXIM \$00	INIT TENS COUNT
0302 38		SEC	
0303 E9 0A	HTA	SBCIM \$0A	SUBTRACT 10 DECIMAL
0305 30 03		BMI HTB	
0307 E8		INX	INCR. TENS DIGIT
0308 D0 F9		BNE HTA	
030A 69 0A	HTB	ADCIM \$0A	UNITS DIGIT
030C 85 04		STA TEMP	
030E 8A		TXA	
030F 18		CLC	
0310 2A		ROLA	
0311 2A		ROLA	
0312 2A		ROLA	
0313 2A		ROLA	
0314 65 04		ADC TEMP	
0316 60		RTS	

#### SUBROUTINE MESSAG

ENTRY JSR MESSAG

THIS ROUTINE WILL PARADE THE MESSAGE SPECIFIED BY THE CALLER ACROSS THE LEDS. THE A REGISTER CONTAINS THE LO BYTE OF THE MESSAGE ADDRESS. THE X REG. CONTAINS THE HI BYTE OF THE MESSAGE ADDRESS. THE FIRST BYTE OF THE MESSAGE CONTAINS THE NUMBER OF BYTES IN THE MESSAGE MINUS 5. THIS COUNT INCLUDES THE FIRST BYTE

0317 8D 24 03	MESSAG	STA	MAD	+01	CHANGE INSTRUCTION
031A 8E 25 03		STX	MAD	+02	
031D 8D 37 03		STA	MADX	+01	CHANGE INSTRUCTION
0320 8E 38 03		STX	MADX	+02	
0323 AD FF FF	MAD	LDA	\$FFFF	ADDRESS WILL BE CHANGED	
0326 85 10		STA	CLIM		
0328 A9 00		LDAIM	\$00		
032A 85 0D		STA	COUNT		
032C 85 0E		STA	LOOPA		
032E 85 0F		STA	LOOPB		
0330 E6 0D		INC	COUNT		
0332 A4 0D	MESS	LDY	COUNT		
0334 A2 00		LDXIM	\$00		
0336 B9 FF FF	MADX	LDAY	\$FFFF	ADDRESS WILL BE CHANGED	
0339 9D 40 A6		STAX	DISBUF		
033C C8		INY			
033D E8		INX			
033E E0 06		CPXIM	\$06		
0340 D0 F4		BNE	MADX		

0342 E6 0D	INC	COUNT
0344 20 06 89	MESSA	JSR SCAND
0347 E6 0E	INC	LOOPA
0349 D0 F9	BNE	MESSA
034B E6 0F	INC	LOOPB
034D A5 0F	LDA	LOOPB
034F C9 02	CMPIM	\$02
0351 D0 F1	BNE	MESSA
0353 A5 0E	LDA	LOOPA
0355 85 0F	STA	LOOPB
0357 A5 0D	LDA	COUNT
0359 C5 10	CMP	CLIM
035B D0 D5	BNE	MESS
035D 60	RTS	

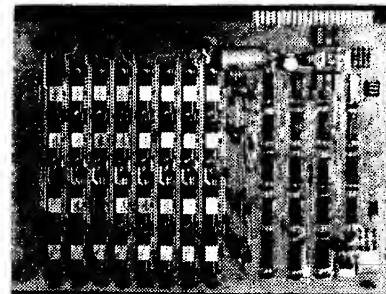
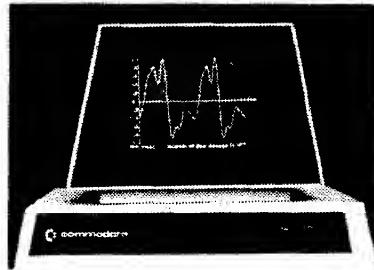
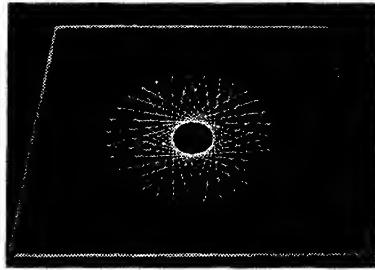
THE FAILURE MESSAGE BEGINS AT LOCATION 0360.  
 THE FIRST BYTE IS THE HEX NUMBER OF BYTES IN  
 THE MESSAGE MINUS FIVE. THE MESSAGE IS IN THE  
 FORM OF SEGMENT CODES. A MEMORY LISTING FOLLOWS.  
 LOAD THIS BEGINNING AT LOCATION 0360.

0360 0B 00 00 6E 3F 3E 00 38 3F 3F  
 0368 3F 3F 6D 79 00 00 00 00

THE SUCCESS MESSAGE BEGINS AT LOCATION 0380.

0380 08 00 00 39 5C 50 50 79  
 0388 58 78 00 00 00

### KIM/SYM/AIM ACCESSORIES BY MTU



#### REAL GRAPHICS FROM OUR VISIBLE MEMORY

Over the last year and a half we have delivered hundreds of our Visible Memory graphic display boards and customers are still finding novel uses for them. The Visible Memory is an 8K byte memory board that is directly compatible with the KIM/SYM/AIM computers and functions just like an 8K memory expansion. Its content however is also displayed on a standard video monitor as a 320 by 200 dot array with each dot corresponding to a bit in memory. Since each dot is individually controllable, any kind of image, even text (22 lines, 53 characters) with subscripts/superscripts is possible. Our assembly language graphics/text software package makes programming the Visible Memory easy. Microsoft 9-digit BASIC users now have access to the graphics and text routines through our just released BASIC Patches Package. In fact, the images above were created entirely with SIMPLE BASIC programs.

#### K-1008A VISIBLE MEMORY \$240.00

#### OTHER ITEMS

KIM Power supply \$35.00      AIM Power supply \$80.00  
 Enclosed card file for 4 boards KIM \$75 SYM \$80 AIM \$95  
 8-bit audio system DAC-Filter-Amp. KIM/SYM/AIM \$40 PET \$50  
 PET to MTU style KIM/SYM/AIM bus adaptor \$79  
 Prototyping board, fits in card file, 2 regulators \$42  
 We have sophisticated music and graphics software too!

PLEASE REQUEST OUR NEW, EXPANDED SPRING 1979 CATALOG

MICRO TECHNOLOGY UNLIMITED, 841 Galaxy Way, Box 4586, Manchester, NH 03103 (603) 627-1464

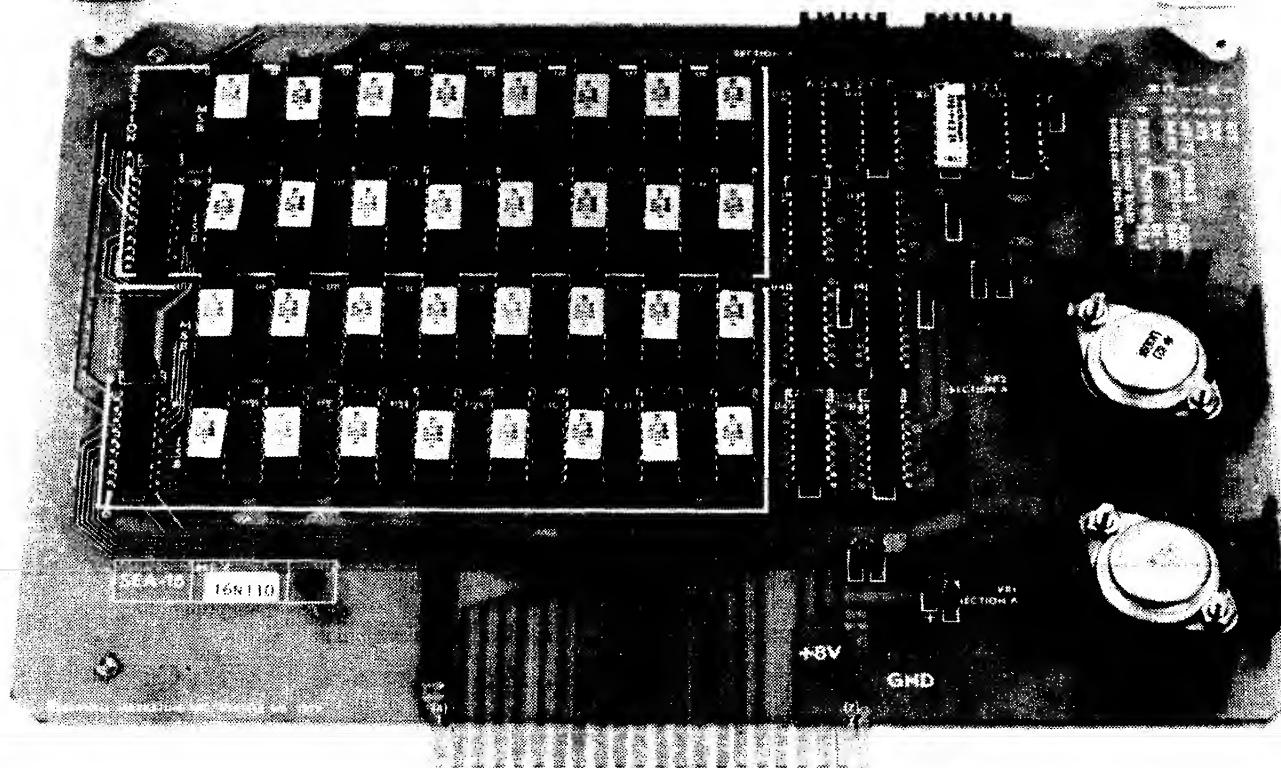
#### 16K LOW POWER MEMORY

Do you want more memory for your KIM/SYM/AIM but don't have a 5 amp power supply or fan to cool it? Our 16K low power dynamic RAM board is designed for these processors and draws a mere 200MA from 8 volts unregulated and 200MA max (75 MA typical) from +16 volts unregulated. Our little K-1000 power supply can in fact run 64K of these boards plus a KIM easily.

#### K-1016A 16K RAM \$340.00

We now have available a multifunction system board for the KIM/SYM/AIM processors. It has a PROM capacity of 12K using the industry standard 2708 PROM or 14K using the readily available TI 2716. Also included is a 2708/2716 PROM programmer, 4 parallel ports, and a bidirectional serial port. Low power: +8 at 350MA, +16 250MA.

#### K-1012A PROM/10 \$237.00



# The best memory board around. Here's why

- Low power 2114 Static RAM's
- Fully buffered
- High quality IC sockets
- All switches accessible from top of board
- Top grade glass fiber PCB, with gold plated contact area.
- Dual regulators

- Two independent 8Kx8 memory banks
- One supply only, 7-9V unregulated

**16K Static RAM \$325.00  
Assembled only.**

**Designed specifically for the: KIM-1, SYM-1, AIM-65.**

Specifications: Access time 450 nS max.

Power consumption 1.35 amp. typ.

Also available: Buffered Mother Board, EPROM Programmer, CVT Power Supply. Software: Standard Forth Compiler, Sea-65 Editor/Assembler.

Order from local dealer or directly from:

**SEAWELL MARKETING INC.**, 315 N.W. 85th, Seattle, WA 98117 • (206) 782-9480

Available in Europe. Write for dealer list.

Check or money order enclosed

Send more information \_\_\_\_\_

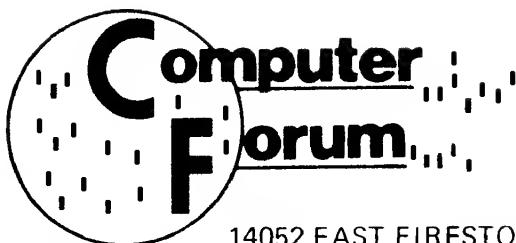
Charge my Master Charge or VISA

Name \_\_\_\_\_

Acct. # \_\_\_\_\_ Expir. Date \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



14052 EAST FIRESTONE BOULEVARD • SANTA FE SPRINGS, CALIFORNIA 90670

(213) 921-2111

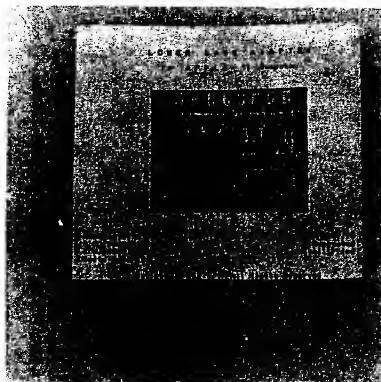
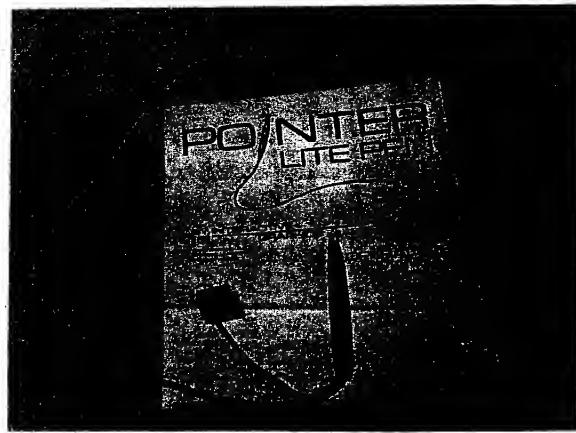
(714) 739-0711

- BUSINESS
- EDUCATIONAL
- PERSONAL

**LIGHT PEN FOR THE APPLE—#035-03610 . . . . . \$ 34.95**

Plugs into the game paddle connector. It includes three demo programs:

1. This demonstration program is a tutorial on the use of the lite pen as a menu selection tool. It is self prompting and instructing and is a perfect example of a realistic lite pen application.
2. This demonstration program is a "low-resolution" graphics demonstration which allows the user to select from a menu of "high-resolution" shapes. In addition, the user is also given the capability of selecting colors from a color menu. Selection from either of the two menus is accomplished by depressing the RETURN key. To place the selected shape on the screen, depress the RETURN key.
3. This demonstration program is a "low-resolution" graphics color bit-pad demonstration. A color menu is displayed and user selects a color by depressing any key. To place the color on the screen, depress any key. To clear the working screen the user depresses the ESC key.



**LOWER CASE ADAPTER FOR THE APPLE II, #042-04479 . . . . . \$ 49.95**  
**WORD PROCESSOR Program that uses the lower case adaptor, #042-04420 . . . . . \$ 59.95**

The lower case adapter will only work in the normal field mode. Inverse or flashing lower case characters will not work. This adapter will increase your Apple into a 96 character character-set. It also includes a few other characters like { } ~ ■ .

**COMMODORE 8K PETs, 8 LEFT AT THE REDUCED PRICE OF . . . . . \$ 699.95**

Plus \$ 15.00 for Shipping & Handling

Call For Confirmation and Reservation

**16K RAM FOR APPLE II, 200NS or Better . . . . . \$ 75.00**

Plus \$ 2.00 for Shipping & Handling

**PROGRAM DESIGN INC.** Software is probably the best written educational software available. We have the complete line of P.D.I. software for the PET™ and the APPLE II. Following is a list of titles available from P.D.I.:

<b>VOCABULARY BLDR. I, #016-01259, 16K INT BASIC:</b> First tape in a two tape course. 10 lessons & 1 quiz ea. tape . . . . .	<b>\$ 13.50</b>
<b>VOCABULARY BLDR. II, #016-01314, 16K INT BASIC:</b> The second tape in a two tape course. 10 lessons & 1 quiz on ea. tape . . . . .	<b>\$ 13.50</b>
<b>PRESCHOOL IQ-BUILDER, #016-01195, 16K INT BASIC:</b> 6 lessons: "Same & Different" & 1 program letter builder . . . . .	<b>\$ 13.50</b>
<b>STEP BY STEP, #016-01356, 16K APPLESOFT II:</b> A tutorial program in computer language of Applesoft II basic. 10 lessons . . . . .	<b>\$ 39.95</b>
<b>WORD MASTER/STORY BUILDER, #016-01399, 16K INT BASIC:</b> Thinking person's game. Nouns, verbs & adjectives . . . . .	<b>\$ 13.50</b>
<b>MEMORY BUILDER, #016-01410, 16K INT BASIC:</b> A concentration game with 20 boxes on screen . . . . .	<b>\$ 13.50</b>

Following is a list of software companies that we deal with. (We are adding new software every month).

APPLE Software Bank • Speakeasy • Powersoft • Forum • Southeastern Software • Wise Owl Workshop • Program Design Inc. Programma International • Personal Software • Quality Software • Peripherals Unlimited Software • George W. Lee Software • Pet Shack Creative Computing • ZZYP-PAX • Softape

<b>Computer Forum</b>	<b>* BUSINESS</b>
	<b>* EDUCATIONAL</b>
	<b>* PERSONAL</b>
14052 East Firestone Blvd. • Sante Fe Springs, CA 90670	
(213) 921-2111 • (714) 739-0711	
NAME _____	
ADDRESS _____	
CITY _____	STATE _____
ZIP _____	PHONE _____

STOCK NO. & DESCRIPTION	PRICE	QUANTITY	AMOUNT
Yes, you may charge it! B of A Card      Mastercharge		Subtotal	
Calif. residents 6% tax			
Expiration Date _____		Shipping	
Card # _____			
Signature _____			
		TOTAL	
		AMOUNT ENCLOSED	

# A 100 uS 16 CHANNEL ANALOG TO DIGITAL CONVERTER FOR 65XX MICROCOMPUTER SYSTEMS

J. C. Williams  
55 Holcomb St.  
Simsbury, CT 06070

Analog to digital (A/D) conversion can be useful in many microcomputer systems. The design presented here takes advantage of a large scale integrated circuit, the ADC0817, to simplify a 16 channel, 8 bit A/D system which can be attached to the bus of 65XX microcomputers. The applications that I have found for this system have included "straight" data acquisition, game joystick position reading, graphic input generation and voice recognition. Of course, the software for each of these applications is different, but they all require multichannel, reasonably fast A/D. The 100 us conversion time of this system depends only on the 1 MHz clock frequency of the microcomputer. The microprocessor is not involved in the A/D conversions. Once the conversion is started, the processor can work on other tasks until the digital result is available.

## The Hardware

This device appears to the programmer as a block of memory starting at a base address, BASE, and extending through 16 locations to BASE + 15. (The actual circuit described occupies 256 locations because of incomplete decoding.) An analog to digital conversion of a selected channel, say channel X, is started by writing to BASE + X. The 8 bit conversion result may then be read from any location in the block (eg. BASE) any time after the 100 us conversion time has elapsed. If desired, the end of conversion signal from the ADC0817 may cause an interrupt to get the attention of the processor. If multiple A/D conversions at the maximum speed are required the 65XX can be kept busy with "housekeeping" during the conversion delay time. The example programs illustrate two ways the converter may be driven. The system uses just five integrated circuits and can be built for less than \$40. The design, shown in Figure 1, occupies a six square inch area on a Vector plugboard and draws only 60 mA of current from the +8 Volt DC unregulated power supply. Operation of the circuit is simple because the ADC0817 performs all analog switching and A/D functions. The base address of the converter is fixed by six switches attached to the DM8131 six bit comparator. When the processor accesses memory locations having address bits A15-A10 matching the switch settings, the DM8131 output goes low. This output is NOR'ed with A9 and A8 to further reduce the memory space occupied by the circuit to one 65XX page. The possible base addresses which can be obtained with this decoder can fall on any 1K boundary and A9 and A8 must be "0's". For example, base addresses (in hex) can be set to A000 or A400 but not A100, A200, or A300. In the design drawn, A9 and A8 must be low for the A/D to be selected, but this could be changed if A9 and/or A8 were inverted using unused sections of the 74LS05. When the A/D is selected, the output of the NOR gate (pin 12 of the 74LS27) goes to a "1"; this can be used as a "board selected" signal if needed (eg. by KIM-1 users for DECODE ENABLE). The microprocessor R/W and 02 lines, along with an inverted board select signal and combined in two NOR gates which 1) latch channel select bits A3-A0 and start A/D conversion during 02 of write cycles and 2) enable the tri-state data bus drivers during 02 of

read cycles. The end of conversion (EOC) signal, produced by the ADC0817 when the most recent conversion has been completed, can be connected to a processor interrupt line through one of the 74LS05 open collector inverters. These interrupts must be cleared by starting another A/D conversion.

Wire-wrap construction is suitable for the circuit and component layout is not critical. It is good practice, however, to orient the analog input area away from digital circuits. The REF + and REF- reference voltages must not be noisy if the full accuracy, 20 mV per bit, is to be achieved. The +5 Volt regulator should not be shared with other circuitry. The layout used in one of the prototypes is sketched in Figure 2. Figure 2 also shows several input connections which may be useful. The circuit has two limitations: 1) input voltages must be between 0 and +5 Volts and 2) signals being converted should not change appreciably during the 100 us conversion period. Both of these limitations may be eliminated by appropriate analog conditioning circuitry, but the simplicity of the design is lost. Builders who want to add features to the circuit should consult the ADC0817 specification and application information.

## The Software

Two example subroutines which use the A/D converter illustrate how it is handled by software. The program which calls the A/D subroutine must initialize both the channel selection and storage defining parameters before the JSR instruction is executed. In the examples, an index register contains the channel selection information because of the ease of using an indexed addressing mode to start a conversion. Data storage is either on page 0 or pointed to by page 0 variables. The A/D subroutines must either contain delays or take enough time between writing to and reading from the ADC0817 to allow it to finish the conversion. Components for this very useful piece of hardware can be obtained from a number of sources readily available to low-volume users. Both National Semiconductor and Texas Instruments produce the ADC0817 and its more accurate counterpart, the ADC0816. The ADC0817 and its data sheet have been recently listed by TRI-TEK, Inc., 7808 N. 27th Ave., Phoenix, AZ 85021. Many other suppliers, such as Jameco Electronics, 1021 Howard Avenue, San Carlos, CA 94979, and Advanced Computer Products, 1310 "B" E. Edinger, Santa Ana, CA 92713, can supply the other components.

# PROGRESSIVE SOFTWARE

PRESENTS SOFTWARE AND HARDWARE FOR YOUR **APPLE**

## SOFTWARE:

### ● Hires Games ●

Missile—Anti—Missile  
Star Wars  
Rocket Pilot  
Saucer Invasion  
Space Maze

By T. David Moteles  
By Robert J. Bishop

### ● Other Program ●

Curve Fit  
Sales Forecasting  
Morse Code  
Calendar  
Polar Coordinate Plot(Hires) By T. David Moteles

by Dave Garson  
by Neil Lipson

by Ed Handley

Programs Require 16K rams and rom board

All Programs. . . . . \$9.95 EACH

## HARDWARE

Neil Lipson's Original Light Pen Includes

5 Programs \$34.95

SEND Check or M.O. to P.O. Box 273, Ply. Mtg., PA 19462

Programs Accepted for Publication- Highest Royalty Paid

Postage and Handling—Add \$1.00 for first item them 50¢ for each add'l

PA Residents Add 6% Sales Tax

MCAD - MULTI-CHANNEL A/D CONVERSION  
J. C. WILLIAMS  
JANUARY 1979

0200		ORG	\$0200	
0200	BASE	*	\$B000	BASE ADDRESS OF ADC0816
0200	STORE	*	\$9000	START OF 16 BYTE STORAGE AREA
0200 9D 00 B0	MCAD	STAX	BASE	START CONVERSION ON CHANNEL X
0203 A0 0E		LDYIM	\$0E	DELAY FOR CONVERSION,
0205 88	DY	DEY		MINIMUM VALUE = \$0E
0206 D0 FD		BNE	DY	
0208 AD 00 B0		LDA	BASE	GET CONVERTED DATA
020B 9D 00 90		STAX	STORE	STORE DATA
020E CA		DEX		
020F 10 EF		BPL	MCAD	DO NEXT CHANNEL
0211 60		RTS		FINISHED

EXAMPLE CALLING ROUTINE FOR MCAD

0212 A2 0F	MCMAIN	LDXIM	\$0F	SELECT CONVERSION OF ALL
0214 20 00 02		JSR	MCAD	16 CHANNELS AND GO TO SUBROUTINE
0217 00		BRK		EXIT ** BE SURE TO INIT IRQ VECTOR **

CXAD SUBROUTINE  
 J. C. WILLIAMS  
 JANUARY 1979

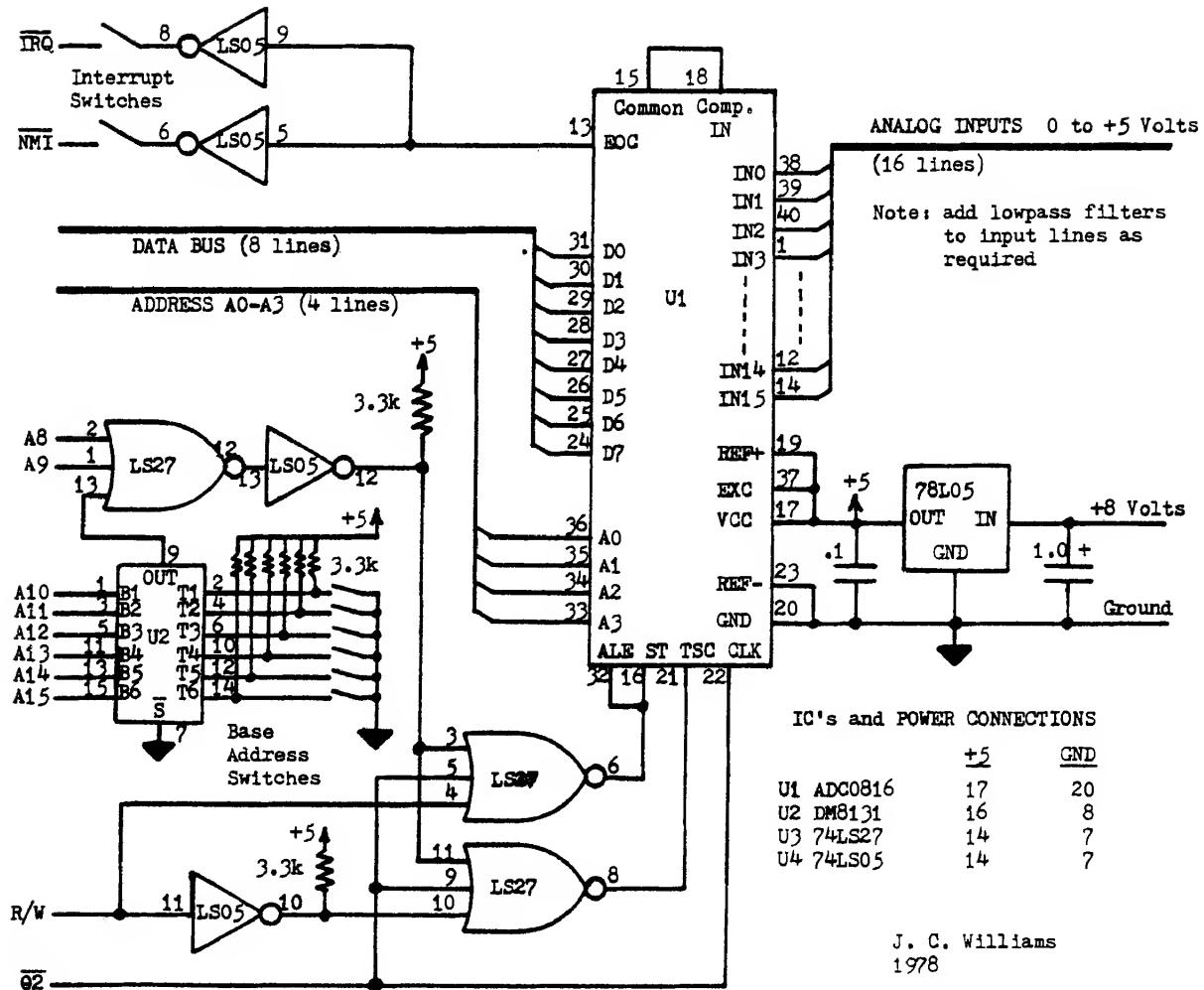
0300		ORG	\$0300	
0300	BASE	*	\$B000	BASE ADDRESS OF ADC0816
0300	SP	*	\$0000	STORAGE POINTER
0300	SPSTR	*	\$0002	LOC OF STORAGE BLOCK START ADDRESS
0300	SPSTP	*	\$0004	LOC OF STORAGE BLOCK END ADDRESS
0300 9D 00 B0	CXAD	STAX	BASE	START FIRST CONVERSION
0303 A5 02		LDAZ	SPSTR	INIT STORAGE POINTER
0305 85 00		STAZ	SP	
0307 A5 03		LDAZ	SPSTR	+01
0309 85 01		STAZ	SP	+01
030B D8		CLD		USE BINARY MODE
030C A0 05		LDYIM	\$05	INSERT DELAY TO ALLOW
030E 88	DY	DEY		INITIAL CONV. TO COMPLETE
030F D0 FD		BNE	DY	
0311 F0 16		BEQ	DELAY	
0313 A5 00	TSTEND	LDAZ	SP	TEST FOR END OF
0315 C5 04		CMPZ	SPSTP	STORAGE BLOCK
0317 A5 01		LDAZ	SP	+01
0319 E5 05		SBCZ	SPSTR	+01
031B B0 1D		BCS	RT	
031D A9 01		LDAIM	\$01	ADD ONE TO STORAGE POINTER
031F 65 00		ADCZ	SP	
0321 85 00		STAZ	SP	
0323 A9 00		LDAIM	\$00	
0325 65 01		ADCZ	SP	+01
0327 85 01		STAZ	SP	+01
0329 A0 05	DELAY	LDYIM	\$05	DELAY TO FIX TIME BETWEEN CONV'S.
032B 88	DYA	DEY		
032C D0 FD		BNE	DYA	
032E AD 00 B0		LDA	BASE	READ CONVERTED RESULT
0331 9D 00 B0		STAX	BASE	START NEXT CONVERSION IMMEDIATELY
0334 A0 00		LDYIM	\$00	SET STORAGE OFFSET
0336 91 00		STAIY	SP	STORE RESULTS
0338 F0 D9		BEQ	TSTEND	ALWAYS TAKEN
033A 60	RT	RTS		

EXAMPLE CALLING ROUTINE FOR CXAD

033B A2 00	CXMAIN	LDXIM	\$00	SELECT CHANNEL 0
033D A9 00		LDAIM	\$00	SET STARTING ADDRESS OF
033F 85 02		STAZ	SPSTR	STORAGE BLOCK TO \$9000
0341 A9 90		LDAIM	\$90	
0343 85 03		STAZ	SPSTR	+01
0345 A9 FF		LDAIM	\$FF	SET ENDING ADDRESS OF
0347 85 04		STAZ	SPSTR	STORAGE BLOCK TO \$9FFF
0349 A9 9F		LDAIM	\$9F	
034B 85 05		STAZ	SPSTR	+01
034D 20 00 03		JSR	CXAD	
0350 00		BRK		EXIT ** BE SURE TO INIT IRQ VECTOR **

FIGURE 1

16 CHANNEL ANALOG TO DIGITAL CONVERTER SYSTEM  
FOR 65XX MICROPROCESSOR SYSTEMS

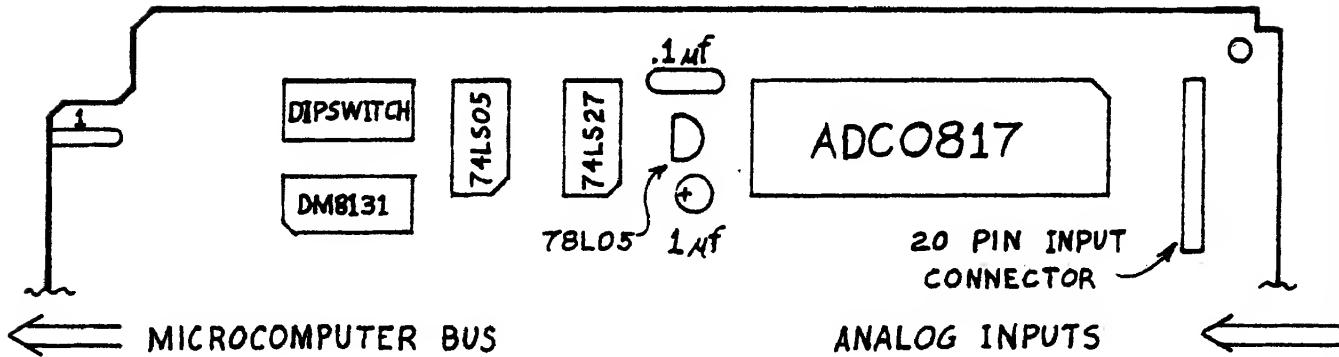


J. C. Williams  
1978

FIGURE 2

# 16 CHANNEL A/D CONVERTER FOR 65XX SYSTEMS

COMPONENT SIDE OF 6.5" X 4.5" PROTOTYPING CARD - VECTOR 3662

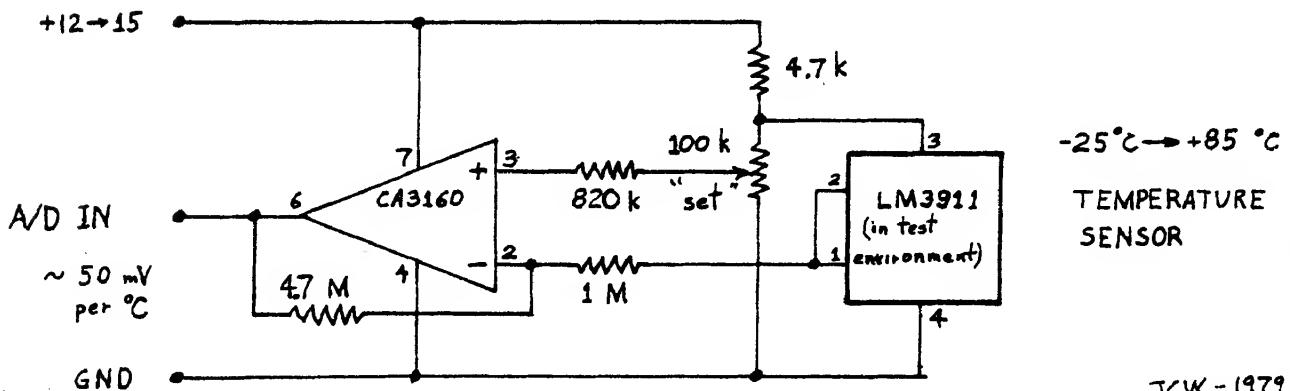
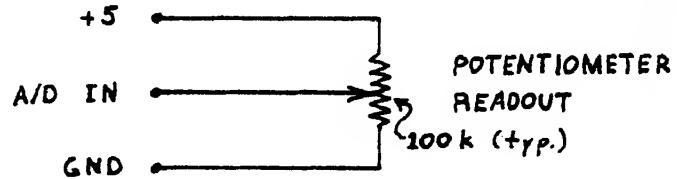
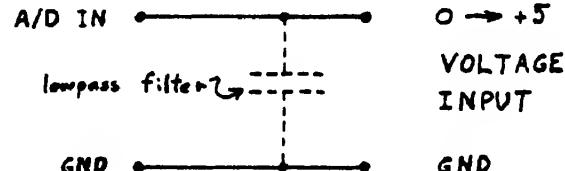


## INPUT CONNECTOR DETAIL

## TOP VIEW

GND	.	.	+5
IN14	.	.	IN15
IN12	.	.	IN13
IN10	.	.	IN11
IN8	.	.	IN9
IN6	.	.	IN7
IN4	.	.	IN5
IN2	.	.	IN3
IN0	.	.	IN1
GND	.	.	+5

## APPLICATIONS





**HUDSON DIGITAL ELECTRONICS, INC.**

BOX 120, ALLAMUCHY, N.J. 07820 • 201-362-6574

# **KIM-1 PRODUCTS FROM HDE, INC.**

## **DM-816-M8 8K STATIC RAM MEMORY**

This is the finest memory board available for the KIM-1 at any price. Commercial/Industrial quality. All boards are continuously operated and tested for a minimum of 100 hours prior to release. Full 6 month parts labor warranty.

## **DM-816-DI1 8" FLEXIBLE DISK SYSTEM**

Available in single and dual drive versions. Includes interface card, power-supply, Sykes controller and drive, cables and manual. File Oriented Disk System software with HDE text editor.

## **DM-816-MD1 5" FLEXIBLE DISK SYSTEM**

Single and dual drive versions include interface/controller, power supply, Shugart drive, cables and manual. Advanced version of FODS software with HDE text editor. Latest addition to HDE peripheral product line.

## **DM-816-CC15 MOTHER BOARD**

A professional mother board for the KIM-1. All KIM-1 functions remoted, includes power on reset. 15 connectors. Provision for Centronics printer interface. Card cage and cabinet configurations available.

## **DM-816-UB1 PROTOTYPE CARD**

Designed for ease of special applications development. Handles up to 40 pin dips.

## **HDE ASSEMBLER**

An advanced, two pass assembler using 6502 cross-assembler mnemonics. Free form, line oriented entry. Directives include: .OPTION, .BYTE, .WORD, .FILE, .OFFSET, .END. Output options include: LIST, NOLIST, SYMBOLS, NOSYMBOLS, GENERATE, NOGENERATE, ERRORS, NOERRORS, TAB, NOTAB. Assemble from single or multiple source files. Place source, object and symbol table anywhere in memory. Automatic paging with header and page number. User's manual. Approximately 4K. Loads at 2000 or E000. Specify on order.

## **HDE TEXT OUTPUT PROCESSING SYSTEM (TOPS)**

A comprehensive output processor, including left, right and full justification, variable page length, page numbering (Arabic or U/C and L/C Roman), page titling, string constants, leading and trailing edge tabbing, field sequence modification, selective repeat, selective page output and much more. Over 30 commands to format and control output of letters, documents, manuscripts. User's manual. Approximately 4K. Loads at 2100 or E100. Specify on order.

## **HDE DYNAMIC DEBUGGING TOOL (DDT)**

Built in assembler/disassembler coupled with program controlled single step and dynamic breakpoint entry/deletion facilitates rapid isolation, identification and correction of programs under development. Key-strokes minimized with single letter, unshifted commands and optional arguments. User's manual. Approximately 2K. Loads at 2000 or E000. Specify on order.

## **HDE COMPREHENSIVE MEMORY TEST (CMT)**

Eight separate diagnostic routines test for a variety of memory problems. Each diagnostic, the sequence of execution, the number of passes and halt/continue on error is selected by the user on call-up. Tests include pattern entry and recall, walking bit, data-address interaction, access time and cross talk, simulated cassette load, slow leaks. Suitable for static and dynamic ram. User's manual. Approximately 3K. Loads at 2000 or E000. Specify on order.

## **HDE TEXT EDITOR (TED)**

Complete, line oriented text editor accepts upper or lower case commands. Functions include line edit, line move, line delete, block delete, resequence, append, list, print, locate, set, scratch, automatic/semi-automatic line numbering, lastcommand recall, job command. This editor is supplied with all HDE Disk Systems. User's Manual. Approximately 4K. Loads at 2000 or E000. Specify on order.

## **ALL PROGRAMS ARE AVAILABLE FOR LOCATIONS OTHER THAN THOSE SPECIFIED AT ADDITIONAL CHARGE.**

	<b>Disk-Note A</b>	<b>Cassette-Note B</b>	<b>Manual Only</b>	<b>Note C</b>
HDE Assembler	\$ 75.00	\$ 80.00	\$ 5.00	\$25.00
HDE Text Output Processing System (TOPS)	135.00	142.50	10.00	15.00
HDE Dynamic Debugging Tool (DDT)	65.00	68.50	5.00	5.00
HDE Comprehensive Memory Test (CMT)	65.00	68.50	3.00	5.00
HDE Text Editor (TED)	N/C	50.00	5.00	15.00

Note A. Media charge \$8.00 additional per order. Save by combining orders.

Note B. Cassette versions available 2nd qtr. 1979.

Note C. Additional charge for object assembled to other than specified locations.

## **ORDER DIRECT OR FROM THESE FINE DEALERS:**

JOHNSON COMPUTER  
Box 523  
Medina, Ohio 44256  
216-725-4560

PLAINSMAN MICROSYSTEMS  
Box 1712  
Auburn, Ala. 36830  
800-633-8724

ARESCO  
P.O. Box 43  
Audubon, Pa. 19407  
215-631-9052

LONG ISLAND  
COMPUTER GENERAL STORE  
103 Atlantic Avenue  
Lynbrook, N.Y. 11563  
516-887-1500

## REAL-TIME GAMES ON OSI

David Morganstein  
9523 48th Place  
College Park, MD 20704

This note discusses how real-time games can be written for OSI Challenger systems which use a serial terminal run from the ACIA. The terminal in my system is an ADM-3A, but the same principal applies to any other. The sample program which is included does use the cursor control procedure of the ADM-3A, but it is a common enough terminal that many readers will be able to use it directly. The cursor control is accomplished in a one-line subroutine and can be changed to another procedure easily. My original goal was to write video games, but I did not have a separate TV monitor, 440 video board and A/D convertor to do this. Fortunately, there was a way!! First, I'll discuss a procedure for polling the serial terminal keyboard and then the video display on the terminal.

The basic idea was to use a PEEK command rather than an INPUT statement. That way the program does not have to stop while the player ponders his response. This was the ONLY way to play Lunar Lander. The typical version gives the Captain unlimited time to ponder his response and minimizes crash landings. Several articles in BYTE and elsewhere talk about using A/D convertors and joysticks. Of course, this is a fine way to go, but the same effect can be created without the added hardware.

The input byte from the ACIA appears at \$FC01. To get a little appreciation for this, look at the ROM monitor routine starting at \$FE00, this is called INCH in the OSD documentation. (See Figure 1.) By peeking at 64513 (\$FC01), you can read the byte sent by the terminal. The only problem with this is the parity bit. That is, the bytes indicating the numbers 0-9 do not increase smoothly but have bit 7 set or not to insure parity. You can solve this by

subtracting 128 when the PEEK (64513) is greater than 128. In the INCH routine this is accomplished with an AND #\$7F, masking bit 7. In this way, you get values from 48 to 57 for the keys 0-9. Now these values can be used to change the burn rate of the lunar lander.

The program is fairly short and is generally self-explanatory. The polling is done in subroutine 5000. The test for 13 is needed since this is a null byte appearing before any keyboard entry has been made. As it now runs, extra boost can be given by typing a non-numeric. This should probably be prevented since it will allow a "sinking ship" to be saved, most unsporting!!

The other interesting feature is the cursor control. This is accomplished in line 6000. The ADM-3A requires two control bytes be sent, CHR\$(27) and CHR\$(61), in order to set up the X and Y coordinates which follow. As given in the subroutine, the X value can be from 1 to 80 and the Y from 1 to 24, which correspond to the column and row (counting from the top left) of the position to be printed. Be careful when using this to not exceed these ranges. The cursor control is used to set-up a "lander control panel" and then update the "meter readings" as the play progresses.

If you're wondering what line 500 does, it's used for timing. By adjusting the variable DE(lay), the speed of the game can be changed slightly. I was shooting for a twice per second update on the panel. Unfortunately, when the LOW FUEL WARNING comes on the timing changes. Well, you can't have everything. (I'm sure somebody out there will figure out how to correct this....)

FE00	ORG	\$FE00
FE00 AD 00 FC	START	LDA \$FC00
FE03 4A		LSRA
FE04 90 FA		BCC START
FE06 AD 01 FC		LDA \$FC01
FE09 29 7F		ANDIM \$7F
FE0B 48		PHA
FE0C AD 00 FC		LDA \$FC00
FE0F 4A		LSRA
FE10 4A		LSRA
FE11 90 F9		BCC \$FE0C
FE13 68		PLA
FE14 8D 01 FC		STA \$FC01
FE17 60		RTS
FE18 20 00 FE		JSR START
FE1B C9 52		CMPIM \$52
FE1D F0 16		BEQ \$FE35
FE1F C9 30		CMPIM \$30
FE21 30 F5		BMI \$FE18
FE23 C9 3A		CMPIM \$3A
FE25 30 0B		BMI \$FE32
FE27 C9 41		CMPIM \$41
FE29 30 ED		BMI \$FE18
FE2B C9 47		CMPIM \$47

```

100 PRINTCHR$(26):X=25:Y=10:GOSUB6000
104 PRINT"U N A R   L A N D E R ":Y=12:GOSUB6000
106 INPUT"DO YOU NEED INSTRUCTIONS (Y/N) ";N$
110 IFN$="N"GOTO190
115 PRINT:PRINT
120 PRINTTAB(10)"THIS IS A REAL TIME LUNAR LANDER SIMULATION.
130 PRINTTAB(10)"TO PLAY, MERELY ENTER THE POUNDS OF
140 PRINTTAB(10)"FUEL WHICH YOU WISH TO BURN BY TYPING A DIGIT (0-9).
150 PRINTTAB(10)"THE NINE GIVES MAXIMUM BURN, SLOWING YOU DOWN AT THE
155 PRINTTAB(10)"FASTEEST RATE. A ZERO GIVES NO BURN AND LETS YOU FRE
160 PRINTTAB(10)"FALL.":PRINT:INPUT"  READY...TYPE GO  ";N$
190 PRINTCHR$(26):Y=4:X=28:GOSUB6000:PRINT"TIME TO FUEL EXHAUSTION"
200 X=20:Y=7:GOSUB6000:PRINT"BURN RATE"
220 X=50:GOSUB6000:PRINT"FUEL"
230 Y=8:X=20:GOSUB6000:PRINT(LBS/SEC)"X=50:GOSUB6000:PRINT"(LBS)"
240 Y=12:X=20:GOSUB6000:PRINT"VELOCITY":X=50:GOSUB6000:PRINT"ALTITUDE"
250 Y=13:X=20:GOSUB6000:PRINT"(FT/SEC)":X=50:GOSUB6000:PRINT" (FT)"
260 Y=18:X=20:GOSUB6000:PRINT"ESTIMATED TIME TO LANDING "
270 Y=22:X=1:GOSUB6000:FORI=1TO79:PRINT"-";:NEXTI
275 Y=23:X=1:GOSUB6000:PRINT"0 "
280 FORI=1TO7:X=10*I:GOSUB6000:PRINTI;:NEXTI
290 X=30:Y=24:GOSUB6000:PRINT"ALTITUDE (X10,000 FT.)":GOSUB6000
310 VE=-100:MT$="           ":FU=10000:AL=80000:DE=5:BU=32
320 FORT=1TO10000
330 IFT/2=ING(T/2)THENPRINTCHR$(7);
340 VE=VE+((BU-32)*25E8)/(25E8+AL*AL))
345 VE=INT(VE)
350 AL=AL+INT(VE/2)
360 IFAL<0GOTO3000
370 IFFU<500THENGOSUB2000
380 FU=FU-BU/2
385 IFFU<=0THENFU=0:BU=0
390 IFBU<=0THENB$="NO BURN":GOTO410
400 B$=STR$(INT(FU/BU))
410 X=38:Y=5:GOSUB6000:PRINTMT$:GOSUB6000:PRINTB$
420 X=21:Y=9:GOSUB6000:PRINTBU:X=50:GOSUB6000:PRINTFU
430 X=22:Y=14:GOSUB6000:PRINTVE:X=50:GOSUB6000:PRINTAL
440 IFVE>=0THENA$="ESCAPE":GOTO460
450 A$=STR$(INT(AL/ABS(VE)))
460 Y=19:X=38:GOSUB6000:PRINTMT$:GOSUB6000:PRINTA$
461 TA=INT((AL+500)/1000):IFTA>80THENTA=80
462 IFTA<1THENTA=1
463 Y=21:X=TA+1:GOSUB6000
465 IFFU=0GOTO500
470 GOSUB5000:IFZ=13GOTO500
480 BU=12+4*(Z-48)
490 IFZ=48THENBU=0
500 FORTI=1TODE:A=SIN(10):NEXTTI
505 VP=VE:AP=AL
510 NEXTT
2000 FORJ=1TO2
2005 X=36:Y=12:GOSUB6000:PRINT"LOW FUEL"
2010 Y=13:GOSUB6000:PRINT"WARNING"
2020 A=SIN(10)
2030 GOSUB6000:PRINTMT$:Y=12:GOSUB6000:PRINTMT$
2035 A=SIN(10)

```

```

2040 NEXTJ
2050 DE=I:RETURN
3000 SP=(VP+VE)/2
3010 IF SP<-25GOTO3200
3015 PRINT:PRINT
3020 PRINTTAB(20)"CONGRATULATIONS, YOU TOUCHED DOWN AT A MERE "
3030 PRINTTAB(30)SP;" FT./SEC. A SAFE LANDING !!!"
3040 PRINT:PRINTTAB(20)" DO YOU WANT TO TRY AGAIN AND"
3050 PRINTTAB(20)" ";:INPUT"PROVE IT WASN'T LUCK ";N$
3060 IF N$="N"THENRUN"BEXEC*"
3070 GOTO190
3200 PRINTCHR$(26)
3210 N=40
3220 FOR I=1 TO N: X=1+INT(79*RND(I)): Y=1+INT(23*RND(1))
3225 GOSUB6000:PRINTCHR$(33+INT(15*RND(1))):GOSUB6000:NEXTI
3230 X=20:Y=10:GOSUB6000:PRINT"YOU JUST BLEW A CRATER,"
3240 Y=11:GOSUB6000:PRINTABS(VE);" FEET IN DIAMETER, ON THE
3250 Y=12:GOSUB6000:PRINT"SURFACE OF THE MOON. BETTER TRY AGAIN...
3260 Y=14:GOSUB6000:INPUT" READY (Y/N) ";N$
3270 GOTO190
5000 Z=PEEK(64513)
5005 IF Z=13 THEN RETURN
5010 IF Z>128 THEN Z=Z-128:RETURN
6000 PRINTCHR$(27);CHR$(61);CHR$(Y+31);CHR$(X+31);:RETURN

```

## P.S. SOFTWARE HOUSE

FORMERLY PETSHACK  
PET™ SCHEMATICS

FOR ONLY \$24.95 YOU GET:

24" X 30" schematic of the CPU board, plus oversized schematics of the Video Monitor and Tape Recorder, plus complete Parts layout - all accurately and painstakingly drawn to the minutest detail.

### PET™ ROM ROUTINES

FOR ONLY \$19.95 YOU GET:

Complete Disassembly listings of all 7 ROMS, plus identified subroutine entry points; Video Monitor, Keyboard routine, Tape Record and Playback routine, Real Time Clock, etc. To entice you we are also including our own Machine Language Monitor program for your PET using the keyboard and video display. You can have the Monitor program on cassette for only \$9.95 extra.

PET to PARALLEL INTERFACE with 5V .8A power supply \$74.95

Send for our free SOFTWARE BROCHURE. Dealer inquiries welcome.

### PET™ EXPANDOR PRINTER

PRINTER PRICE WITH PET INTERFACE \$525

- Small size of 4.5" H x 12 1/2" W x 9 1/2" D
- Impact printing - 3 copies
- Prints 80 columns wide
- Print Cylinder - not a matrix
- Uses 8 1/2" paper, pressure or pin feed
- Easy to maintain yourself, or return to us
- Regular Paper - Coated paper not required
- Lightweight, 11 1/2 lbs. with cover
- Prints 10 characters per second
- 64 Character ASCII Character Set
- Full Documentation Included



This is the ideal, low cost, reliable, self maintained printer with which to complete your PET™ system.

## P.S. SOFTWARE HOUSE

P.O. Box 966

Mishawaka, IN 46544



Tel: (219) 255-3408



PET is a trademark of Commodore Business Machines

FOR PET, TRS 80, COMPUCOLOR.



**SOUNDWARE** adds music and sound effects to your computer. Includes DEMO PROGRAM, SOUND COMPOSER (to create your own BASIC sound subroutines) and instructions. Unit has volume control, earphone jack, connectors. 1 year warranty. \$29.95 for PET & TRS-80. \$39.95 for Compucolor (includes diskette).

### SOUNDWARE SOFTWARE FOR 8K PET!

Compatible with all CB-2 sound devices. Features sound, super graphics, instruction booklet. 90 day warranty.

1. ACTION PACK—Breakthru (8 versions) / Target / Caterpillar
2. THE CLASSICS—Checkers (8 versions) / Backgammon / Piano Player
3. WORD FUN—Speller (4 versions) / Scramble / Flashcard

\$9.95 per pack or 3 packs plus bonus program for \$29.00. More sound programs coming: TRS-80 and Compucolor, too!

To Order: Send to CAP Electronics, Dept. M14, 1884 Shulman Ave., San Jose, CA 95124, or call (408) 371-4120. VISA/Master Charge accepted. No charge for shipping when payment is included. Please add 15% for C.O.D. Calif. residents add 6% tax.

Prices subject to change without notice.

DEALER & DISTRIBUTOR INQUIRIES WELCOME

**PET™**

**We have the Most Complete Stock of **APPLE** and  
PET Software in Southern California.  
(Send for our Catalog — \$1.00)**

**16K RAM CHIP SET FOR APPLE II  
ONLY (Tested & Burned In) . . . . . \$95.00**

**WORKSHOPS: Call for details.**

- PET—3rd Saturday of the Month
- APPLE—4th Saturday of the Month

**CLASSES: Apple Topics**

We offer a series of classes on Apple II to acquaint owners with some of the unique features and capabilities of their system. Topics covered are Apple Sounds, Low Res. Graphics, Hi Res. Graphics, Disk Basics, and How to Use Your Reference Material. Sessions are held every Thursday Night at 7:00 p.m.

## HARDWARE

**APPLE II HARDWARE:**

- **Upper & Lower Case Board**  
Now you can display both upper and lower case characters on your video with the Apple II. Includes assembled circuit board and sample software . . . . . \$49.95
- **Programmer Aide** . . . . . \$50.00
- PRINTER SPECIALS FOR APPLE AND PET**
- **TRENDCOM 100** with Interface for Apple or PET . . . . . \$450.00

**LIMITED QUANTITY**

Refurbished Selectric typewriters serially interfaced for plug in to **APPLE II** . . . . . \$1000.00  
All orders must be prepaid. Delivery in 4 to 8 weeks A.R.O. or full refund.

- **Anadex DP-8000** with tractor  
8" paper width and Apple interface . . . . . \$1050
- **Centronics 779-2 for Apple II**  
With parallel Interface . . . . . \$1245.00

**JOIN THE APPLE COMMUNICATION NETWORK  
(APPLE COM-NET)**

Computer Components of Orange County is initiating a communication network for all **APPLE OWNERS**. We need the help of dedicated Apple users. Become a **CHARTER MEMBER** of this **APPLE TEAM** by helping us set up this network. Contact Dave Smith or Dwain Graham 714-891-2584.

**\*\*COMPLETE COMMUNICATION HARDWARE\*\*  
FOR YOUR APPLE \*\*\*\*\$379.00\*\*\*\***

**See if you qualify for a CCI of OC P/F Card  
and get great discounts on selected  
purchases for your Apple and PET.**

**WHY SHOULD YOU BUY FROM US?**

Because we can help you solve your problems and answer your questions. We don't claim to know everything, but we try to help our customers to the full extent of our resources.

—Prices subject to change.—

## COMPUTER COMPONENTS OF ORANGE COUNTY

6791 Westminster Ave., Westminster, CA 92683 714-891-2584

Hours: Tues-Fri 11:00 AM to 8:00 PM—Sat 10:00 AM to 6:00 PM (Closed Sun, Mon)

Master Charge, Visa, B of A are accepted. No COD. Allow 2 weeks for personal check to clear.  
Add \$1.50 for handling and postage. For computer systems please add \$10.00 for shipping, handling and  
insurance. California residents add 6% Sales Tax.

**Reference Books For **APPLE** and PET Owners**

Programming the 6502 . . . . .	9.95
PET User Manual (New from Commodore) . . . . .	9.95
First Book of KIM . . . . .	8.95
MOS Tech Programming Manual (6502) . . . . .	12.00
MOS Tech Hardware Manual . . . . .	12.00

**PET HARDWARE**

- **PET 2001-8 Computer** Standard PET with integral cassette and calculator type keyboard 8K bytes of memory (7167 net) . . . . . \$795.00
- **PET 2001-16N Computer** PET with 16K bytes of memory and large keyboard with separate numeric pad and graphics on keys. External Cassette optional. (15,359 net) . . . . . \$995.00
- **PET 2001-16B Computer** As above but has standard type-writer keyboard. No graphic keys . . . . . \$995.00
- **PET 2001-32N Computer** Identical to 2001-16N with 32K bytes of memory. (31,743 net) . . . . . \$1,195.00
- **PET 2001-32B Computer** Identical to 2001-32N with 32K bytes of memory. (31,743 net) . . . . . \$1,195.00

**PERIPHERALS**

- **PET 2021 Printer** 80 column dot matrix electrostatic printer with full PET graphics capability . . . . . \$549.00
- **PET 2022 Printer** 80 column dot matrix printer with plain paper or forms handling tractor feed. Has full PET graphics . . . . . \$995.00
- **PET 2023 Printer** 80 column dot matrix printer. Plain paper printer with full PET graphics . . . . . \$849.00
- **PET 2040 Dual Drive Mini Floppy Disk**\* Dual drive intelligent mini floppy system. 343K net user storage capacity . . . . . \$1,095.00
- **PET 2041 Single Drive Floppy Disk** Single drive intelligent mini floppy 171.5K net user storage . . . . . \$595.00
- **PET External Cassette** Cassette player/recorder to use with PET 2001/8/16/32 . . . . . \$95.00
- **PET User Manual** 160 page expanded user manual covering all facets of user operation, programming and I/O for PET computers . . . . . \$9.95

\*Retrofit kit required for operation with PET 2001-8.

## ASK THE DOCTOR - PART IV GOOD NEWS/BAD NEWS

Robert M. Tripp, Ph.D.  
The COMPUTERIST, Inc.  
P.O. Box 3  
So. Chelmsford, MA 01824

In last month's issue I announced that Synertek Systems has informed me of an improvement to the SYM monitor which should solve the audio cassette sensitivity problem that I had mentioned in several columns. I have since received a copy of the new SYM-1 Supermon Version 1.1 on a pair of EPROMs (which I had supplied to them) and have had some chance to evaluate the new version. The documentation I received was in the form of a two page letter. Not having the monitor listing limited by ability to fully evaluate the changes.

### The Good News

According to the letter only two minor hardware changes are required in the cassette circuit. These are similar to some reported independently by other users and reported in an earlier column. "Change C16 to .22 microfarad" and "change R97 to 1K ohm".

This list of improvements that accompanied the V1.1 monitor, along with my comments appears below. (The Synertek notes are in bold face. My comments are normal type.)

1. **The Improved High Speed Cassette** read/write is significantly better than before. I was able to write and read quite constantly and was able to produce a tape on one type of recorder and read it on another. The volume/tone range was much wider. Whereas before you had to be right on for any chance of success, now you can have a reasonable variation in volume and tone and still get a good read. This is particularly important when you are using different recorders with different characteristics. The two recorders I tested with were a Superscope C-190 and a Pioneer Centrex. These fairly high quality recorders have **not** worked reliably with the old V1.0 monitor. A suggestion I had made to Synertek back in June 1978 was to make the leader time variable. While the 8 seconds they had built-in in V1.0 is acceptable when you are only occasionally storing a program, it was much to long if you intended to use the tape service to save small chunks of data - mailing list information for example. The above note says that the leader time is now maintained in ram and can be changed by the user if necessary. Since I did not have the listing or additional information, I was not able to test this out. But, assuming it does work, this can be a very significant improvement. Some programs I have written require a lot of extra code simply to get around the "fixed" leader problem. They should be much simpler now, since I should be able to set the leader time in ram and then use the tape cassette routines directly.
2. **KIM read. Read routine improved.** This has been one of the biggest problems for the SYM-1 since its release. The V1.0 monitor had a simple, but powerful, bug. It made an invalid test for the KIM format "end-of-data" character, and treated the legal 32 46 ASCII pair as an ASCII "/", thereby terminating prematurely whenever it encountered a "2F" in the data. This made the KIM format mode of the SYM-1 essentially useless. This has been fixed in the new version. This means that it is now possible to distribute software, data bases, source files, etc. between the KIM-1, SYM-1 and AIM 65 using the common KIM format.
3. **Beeper frequency adjusted for maximum output.** I'll take their word for this. It does sound a little louder, but then I had never had any trouble with the beeper in V1.0.

4. **During the VERIFY command a BREAK key will stop printout without printing an error message.** I didn't test this minor improvement, but it is nice to keep error messages for real errors.

5. **BREAK key is looked for on current loop interface.** If you are using a teletype device, it is handy to have the BREAK key work, so this change is definitely good.

6. **Log-on changed to SY1.1.** Yes.

7. **After paper tape load the error message count is displayed.** I do not have any paper tape facility to test this, but it is a minor improvement.

8. **Ability to return to a higher level program (left arrow).** I do not quite understand what this is supposed to mean, but I am sure when additional documentation is available it will make sense.

9. **Cassette file I.D. displayed on left digit seven segments.** This is both cute and useful. They have simply taken the ID value and put it out on the leftmost digit. It does take a bit of deciphering though. The figure below shows the value of each segment on the display. These must be separately read and then added together to get the file ID. It is useful when you are searching the tape for a particular tape ID.

10. **Unwrite-protect routine added to cassette logic.** Again, I could not test this due to zero documentation.

11. **Register name improvement on display during R command.** Hooray! Now the display shows the register name, not a "hard-to-remember-and-interpret" arbitrary number to identify which register you are examining. P for program counter; S for stack; F for flags; A for A register, X to represent an X for the X register; and Y for the Y register. A simple but very nice improvement.

12. **Debug-on will not cause ram to be write protected.** I did not test this, but it sounds reasonable.

That's the good news.

### The Bad News

The bad news isn't all that bad, but should be considered. First, the changes to the Supermon do move some code around and change some "internal" entry points. Although the Synertek programmer I talked to said that this was not going to be very important since the main entry points were not touched, I found the first program I tried to run, the SYNC generator from the Reference Manual, would not work since two of the routines it requires have moved. How great a problem will this be? It is difficult to guess. I haven't seen the listings and do not know what routines were changed and also do not know how often other programmers have used them directly. It will be a problem for anyone who is trying to make program for distribution since there may be a requirement for two versions - one for V1.0 and another for V1.1 - and this adds to the expense and can cause distribution problems. Hopefully, the number of routines affected is small and isn't a big problem - but at present, "Who knows?"

Second, the V1.1 does use up some (most?, all?) of the Scratch Pad RAM in the System RAM. While this is not necessarily a big problem for future programs, it may cause problems for existing programs which use this previously available resource. Care will have to be taken when transferring programs from V1.0 to V1.1 to take this change in scratch pad availability into account.

Third, Synertek does not seem to have a policy yet for how the new V1.1 will be distributed. They are still waiting for feedback from myself and a couple of other users before committing to ROM, so it will be some time before any of the V1.1 are available at all. Then there is the question of systems already in the field or on dealer's shelves. Will there be a reasonable "exchange" policy, say Synertek's actual ROM production cost of \$10-\$15.00, or is some outlandish price going to be charged. I strongly feel that Synertek has the responsibility to offer the new V1.1 at the lowest price possible. Some of the changes they have made are not "cosmetic" or simple "improvements". They are basic "corrections" to their original "flawed" V1.0.

#### SYM-1 Codes

Ever wonder what the various codes were that the SYM used: key-code, ASCII code, and display code? You can look them up in the SYM manual in various places, but, why not let the SYM itself generate a display of these codes. The following program is an aid in establishing the relations between the three different codes. Start the program at 0000. The display goes blank, and when a key is depressed, the display will show key code, ASCII and display-scan code for a short time, and go blank again with a "beep".

Submitted by  
Jan Skov  
Majvaenget 7  
DK-6000 Kolding  
The Netherlands

#### SYM-1 CODE DISPLAY

JAN SKOV

FEBRUARY 1979

0000	ORG	\$0000
------	-----	--------

#### SYM SUBROUTINES

0000	ACCESS	*	\$8B86	SYSTEM RAM ACCESS
0000	SPACE	*	\$8342	OUTPUT SPACE TO DISPLAY
0000	INCHR	*	\$8A1B	INPUT CHARACTER
0000	OUTCHR	*	\$8A47	OUTPUT CHARACTER
0000	OUTBYT	*	\$82FA	OUTPUT BYTE
0000	SCAND	*	\$8906	SCAN DISPLAY
0000	BEEP	*	\$8972	

0000 20 86 8B	START	JSR	ACCESS	
0003 A2 06		LDXIM	\$06	
0005 20 42 83	LOOP	JSR	SPACE	
0008 CA		DEX		
0009 D0 FA		BNE	LOOP	
000B 20 1B 8A		JSR	INCHR	
000E 85 EF		STAZ	\$00EF	
0010 A9 2D		LDAIM	\$2D	
0012 20 47 8A		JSR	OUTCHR	
0015 A5 EF		LDAZ	\$00EF	
0017 20 FA 82		JSR	OUTBYT	
001A AD 42 A6		LDA	\$A642	DISPLAY BUFFER
001D 20 FA 82		JSR	OUTBYT	
0020 A2 0B		LDXIM	\$0B	
0022 86 EE		STXZ	\$00EE	
0024 86 ED		STXZ	\$00ED	
0026 20 06 89	LOOPA	JSR	SCAND	DISPLAY AND
0029 C6 ED		DECZ	\$00ED	TIMER LOOP
002B D0 F9		BNE	LOOPA	
002D C6 EE		DECZ	\$00EE	
002F D0 F5		BNE	LOOPA	
0031 20 72 89		JSR	BEEP	
0034 4C 00 00		JMP	START	

## THE MICRO SOFTWARE CATALOG: VIII

Mike Rowe  
P.O. Box 3  
S. Chelmsford, MA 01824

### Name: **Missile-Anti-Missile**

System: **Apple**  
Memory: **16K**  
Language: **Apple II Soft**  
Description: Simulated missile attack on 3-D Map of USA  
Copies: **30**  
Price: **\$9.95 + \$1.00 postage & handling**  
Includes: Cassette with instructions  
Author: **T. David Moteles & Neil Lipson**  
Available from:  
    Progressive Software  
    P.O. Box 273  
    Plymouth Mtg., PA 19462

### Name: **DISK DUMP/RESTORE**

System: **Apple II with disk**  
Memory: **32K (min)**  
Language: **Applesoft II and machine language**  
Hardware: **Apple II, Disk II**  
Description: A disk-tape utility to dump and restore all Integer, Applesoft II, and Binary programs automatically. The program names, Binary program addresses, and all commands necessary to re-load the programs from tape and restore them again to disk under their original names are stored on tape header file.  
Copies: **Just released**  
Price: **\$8.00**  
Includes: Cassette and instructions  
Author: **Alan G. Hill**  
Available from:  
    Alan G. Hill  
    12092 Deerhorn Dr.  
    Cincinnati, Ohio 45240

### Name: **NOT ONE**

System: **KIM**  
Memory: **1K**  
Language: **Assembly**  
Hardware: **Bare Kim!**  
NOT ONE is an exciting, fast moving game of skill, strategy, and change for one to five players (including KIM). The game is designed for use with KIM's onboard display and hex pad.  
Besides being an entertainment game, the NOT ONE package was designed to introduce some powerful general-purpose output manipulation subroutines for the KIM's LED display. These include variable-speed, scrolled alpha-numerics!  
The manual also discusses LED segment codes in an effort to increase the user's knowledge of the display.

Author: **Steven Wexler**

Price: **\$15.00**

Includes: Source listing, manual, and cassette

Available from:

    SJW, Inc.  
    P.O. Box 438  
    Huntingdon Valley, PA. 19006

The 6502 Program Exch.

2920 Moana  
Reno, NV. 89509

### Name: **A Forth System**

System: **Apple II**  
Memory: **24K or Larger**  
Language: **40% ASSEMBLY, 60% Forth**  
Hardware: **Disk II**  
Description: A unique software package for software buffs and serious programmers who have gotten tired of programming in integer basic and machine language. FORTH is an extensible language, allowing the programmer to "define" new dictionary entries that use previous entries. Most of FORTH is written in FORTH. Benchmarks show that FORTH executes 20 times faster than BASIC. Included in the package are:  
1) Powerful screen editor for system development.  
2) Decompiler - used to generate to some extent a source listing. It can be used to list our portions of FORTH itself.  
3) Utility package - dump, disk maintenance etc. does not use apple II dos.  
4) Completely documented using a special disk retrieval system. includes some programming examples. Editor, decompiler is available on source.  
Copies: **Just Released**  
Price: **\$39.95 + tax for California residents**  
Includes: One mini diskette + manual  
Author: **John T. Draper**  
Available from:  
    Captain Software  
    PO Box 575  
    San Francisco, CA 94101

### Name: **Function Graphs and Transformations**

System: **Apple II**  
Memory: **16K minimum if Applesoft is in ROM, otherwise 32K minimum**  
Language: **Applesoft (floating point Basic)**  
Hardware: **No special hardware**  
Description: This program uses the Apple II high resolution graphics capabilities to draw detailed graphs of mathematical functions which the user defines in Basic syntax. The graphs appear in a large rectangle whose edges are X and Y scales (with values labeled by up to 6 digits). Graphs can be superimposed, erased, drawn as dashed (rather than solid) curves, and transformed. The transformations available are reflection about an axis, stretching or compressing (change of scale), and sliding (translation). The user can alternate between the graphic display and a text display which lists the available commands and the more recent interactions between user and program. Expected users are engineers, mathematicians, and researchers in the natural and social sciences; in addition, teachers and students can use the program to approach topics in (for example) algebra, trigonometry, and analytic geometry in a visual, intuitive, and experimental way which complements the traditional, primarily symbolic orientation.

Copies: **Just released**

Price: **\$14.95 (Cat. No.: AHE0123)**

Includes: cassette tape, 12-page instruction booklet

Author: **Don Stone**

Available from: many computer stores or

    Powersoft, Inc.  
    P.O. Box 157  
    Pitman, NJ 08071  
    (609) 589-5500

Name: **6502 VDR**  
Systems: Any 6502 with room available at \$200 or \$DD00  
Memory:  $\frac{1}{2}$ K  
Language: **6502 machine code**  
Hardware: **Memory-mapped video board such as Polymorphic Systems VTI, Solid State Music VB-1B, Etc.**  
Description: Organizes memory-mapped display for teletype-like use including automatic scrolling, line wrap-around, clear screen commands, etc.  
Copies: 30  
Price: **\$9.50 plus \$1 shipping**  
Includes: Operating Manual, detailed configuration information, and complete commented source listing.  
Order: Package includes KIM compatible tape cassette with both \$200 and \$DD00 versions included. Charge cards, phone and mail order accepted.  
Available from:  
Forethought Products  
97070 Dukhobar #D  
Eugene, Oregon 97402

Name: **CHEQUE-CHECK™**  
System: **PET**  
Memory: **8K**  
Language: **BASIC, with machine language subroutine**  
Hardware: **PET 2001-8 (or 2001-16/32 on special order)**  
Description: CHEQUE-CHECK reduces the probability of error in reconciling bank statement and checkbook, even for those experienced in the art. More important it greatly reduces the time required to find and correct an error when one does occur, because it "remembers" individual entries for later review and modification if necessary. Designed and tested for ease of use, CHEQUE-CHECK is suitable for novice or expert, and requires no tape files or knowledge of programming. Reviewed in May 1979 issue of Robert Purser's Reference List of Computer Cassettes.  
Copies: **60 sold in first three months.**  
Price: **\$7.95 (quantity discount available)**  
Includes: Cassette in Norelco style box, Description and operating instructions, zip-lock protective package.  
Designer: **Roy Busdiecker**  
Available from: Better computer stores or directly from  
Micro Software Systems  
P.O. Box 1442  
Woodbridge, VA 22193

Name: **Disk Catalog Program**  
System: **Apple II**  
Memory: **32 K minimum**  
Language: **Integer Basic and Machine Language**  
Hardware: **Apple II, DISK II**  
Description: This program consists of two modules. The first, DCATPRO, is a general purpose data base catalog program for books, records, tapes, programs on diskette, etc. Features include 40 col. records, 5 fields (2 with adjustable length), and super fast machine language sort. The second, GENCPINP, automatically processes any set of Apple II diskettes and generates a data base for DCATPRO by reading the D\$CATALOG information for each diskette. Then you know what you have and **where it is**, all without having to type in a lot of data.  
Copies: **Over 100 sold**  
Price: **\$10.00 postpaid**  
Includes: Programs on cassette and 5 pages of documentation  
Arthur: **George W. Lee**  
Available from:  
George W. Lee  
18003 S. Christina Ave.  
Cerritos, California 90701

Name: **Generalized File Management**  
System: **APPLE II**  
Memory: **16K**  
Language: **Integer Basic**  
Hardware: **APPLE II, DISK II**  
Description: This package allows you to create, update, and print disk files. The names of fields and files, number of fields, individual field lengths, and file size is user defined. You can decide what headings you want to see (if any) when you print or display and record or the entire file. You can use this package to create such files as: Parts lists, phonenos., List of birthdates, name and address, and whatever...  
Copies: **Just released**  
Price: **\$16.50**  
Includes: Diskette that contains two programs, some sample file usages (birthdates, parts list), and a user manual.  
Author: **Lee Stubbs**  
Available from:  
Les Stubbs  
23725 Oakheath Pl. Harbor City, Ca 90710

Name: **WEAVER**  
System: **Apple II**  
Memory: **32K**  
Language: **Integer Basic**  
Hardware: **Disk II**  
Description: WEAVER simulates as multi-harness loom with control of warping, hook-up and treadling. Weaving drafts of 40 threads of warp and 40 threads of weft are drawn in 15 colors for patterns requiring up to 24 harnesses. Weaving patterns are saved and called by name from disk storage. The user-interface is designed for easy and efficient use by a weaver. Nine pages of documentation include a glossary of commands which defines the functions of the program and a sample draft with descriptive data entry.  
Copies: **New program.**  
Price: **\$15.00 on cassette tape, \$20.00 on diskette with five sample drafts.**  
Author: **Bruce Bohannan**  
Available from:  
Bruce Bohannan  
2212 Pine Street  
Boulder, CO 80302

Name: **Address and Perpetual Calendar**  
System: **APPLE II**  
Memory: **32K**  
Language: **Applesoft II**  
Hardware: **APPLE II w/Disk II**  
Description: This program maintains your master address file on disk. User follows a master menu to add or change names, look for specific names or review entire file (or part) name by name. All outputs are formatted. Look and change records with a search function i.e., If you do not remember how to spell a name then enter the number of letters you do know and the program will walk you through all names beginning with what you entered until you find the one you want. A birthday function is included that will search your entire file and list all names, birthday and age for any given month. A special feature loads up a Perpetual Calendar program that will display any month (formatted) between the years 1704 and 2099 and highlights any particular day. Return to address program is optional.  
Copies: **Just released.**  
Price: **15.00 ppd**  
Includes: Disk and instructions  
Author: **Edward S. Kleitches**  
Available from:  
Edward S. Kleitches  
7207 Camino Grove  
San Antonio, Texas 78227

## INSIDE THE KIM TTY SERVICE

Ben Doutre  
621 Doyle Road  
Mont St-Hilaire, Quebec  
Canada J34 1M3

The fact the KIM's serial TTY port, plain and unmodified, will operate comfortable at 9600 bauds does not seem to be widely known. I, for one, went the parallel interface route as soon as I acquired a higher speed terminal, and I suspect that many others may have done likewise. After all, what can one expect of an interface described in the User's Manual in these terms: "You are not restricted to units with specific bit rates (10 CPS for TTY) since the KIM-1 system automatically adjusts for a wide variety of data rates (10 CPS, 15 CPS, 30CPS, ETC.)" That's pretty wide, alright, from 10 to etc. Other writers have been equally vague. Gary Tater in MICRO 9:14, "A Fast Talking TIM" mentions that "KIM can adapt to terminal frequencies up to 2400 baud...". This was the last straw, and I either had to pull the plug on my "Fast Talking KIM", or attempt to put the record straight.

First off, let me say that according to my interpretation of what goes on in KIM, the theoretical maximum baud rate of the TTY port is 15,625. How's that for pinning down the etc? Not that you should try to operate at this rate without some of the well-known "fine tuning", but there is no reason why you can't hook up your 9600 or 4800 baud terminal, with 30 cents worth of gates, and be up and running, with or without reading the following details. If you want to know from whence this bonanza, here is the story.

The smarts for the KIM TTY interface are in the monitor software, so let's start at that end. There are two main TTY I/O routines: GETCH at 1E5A and OUTCH at 1EA0. GETCH returns with the character in A but strips off the parity bit in the process. If you need bit 7 (counting from 0) for your own deep, dark reasons, then retrieve the full character from CHAR at OOFF on your return. OUTCH (love that label!) outputs a stop bit, then a start bit, then 8 data bits (LSB first), then another stop bit. It may seem illogical to start with a stop, but remember that, aside from slow machinery, the main purpose of a stop bit (line high) is to make sure that the start bit (line low) will be recognized. In any case, the stop interval is 2 bits long plus the delay between calls to OUTCH.

Both GETCH and OUTCH are timed by subroutine `DELAY`, at IED4. (GETCH also used `DEHALF` to move its strobe to the mid-point of a bit interval, but let's not get technical.) `DELAY` does its thing based on the contents of a 16-bit counter named, for some obscure reason, CNTH30 (high byte, at 17F3) and CNTL30 (low byte, 17F2). If this counter is equal to 0000 or less, `DELAY` falls through all the way, with a resulting minimum bit time of 64us. (Let's assume your crystal is bang-on 1 MHz.) Presto: devide 64us into a million, and you come up with 15,625 baud.

Not convinced? OK, here's more. Every time we add one to the counter, `DELAY` adds another 14 us to its timing loop. The high end of the baud scale looks like this:

Counter	Bit Time (us)	Baud Rate
0000	64	15,625
0001	78	12,820
0002	92	10,869
0003	106	9,434
0004	120	8,333

If we turn this around and start with some of the usual standard baud rates, we can calculate the bit times and counter values required. For instance, 9600 bauds obviously needs something between 2 and 3. `DELAY` doesn't do fractions - it doesn't even like odd numbers. And how does the counter get properly loaded anyway?

We've left the best to the last, a little jewel called DETCPS at 1C2A. DETCPS is entered following a system reset with TTY enabled. Its brief hour of glory is in measuring the duration of the start pulse of the first character you feed in after a Reset. It quickly stuffs the results in the 16-bit counter, then goes out for coffee until the next Reset. The question is: will DETCPS buy 9600 bauds? The answer is YES, albeit a little reluctantly. The thing is the DETCPS is sampling the input port, waiting for the line to go low - it checks for this every 9 us, so it could miss your start pulse start by this much. Once the line is low, it squirrels away 14 us counts, checking for line high every 14 us. So it could miss the end of your start pulse by 14 us.

At 10, 15, 30 or etc CPS, this sloppiness is probably acceptable. With a Model 33 on the line, DETCPS gaily reports 02C2 plus/minus OB, for instance. But if it comes up with 0004 instead of 0003 at 9600 bauds, your TV screen will give you a reasonable facsimile of a Chinese fortune cookie slip. Just look at it as another Butterfield game - Reset-Delete-Reset-Delete-Reset-Delete BINGO! Anyway, how many times a day do you Reset? Once you get that 3, your link with KIM will be rock solid.

There are a number of facinating details, but I will spare you the pyrotechnics. If all this is on the leve, I should be able to prove it, right? Well, I have an ESAT-100 (RHS Marketing) video board equipped with an AY3-1015 UART hooked up to the KIM TTY port. The manual admits to a -1% to DETCPS. I set the speed selector switch to each of the 6 rates available, did 10 resets at each and recorded the counts. (A clever piece of programming, at that!) Except for 9600, all resets were OK the first time around. The counts did not vary, except for 300 baud. The results look like this:

Baud Rate	Bit Time (us)	Calc. Count	Meas'd Count
9600	104.2	0003	0003
4800	208.3	000A	000B
2400	416.7	0019	001A
1200	833.3	0037	0038
600	1666.7	0072	0074
300	3333.3	00EA	00EC/00ED

A few further words of explanation for the fellow who may be hung up because he has been spared intimate relations with "real" TTY machines. (You experts can go figure out an algorithm or two - try infinite recursion on "Every rule has an exception, except this one.")

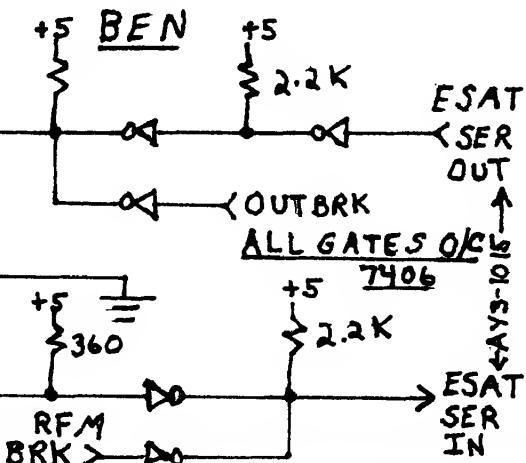
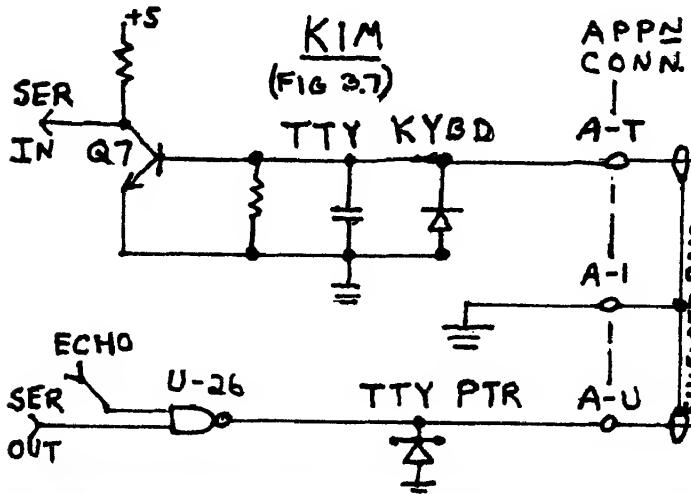
Referring to the KIM-1 User's Manual, Fig. 3.7, you will see two KYBD lines and two PTR lines. The action at the other end of these lines is assumed to be as follows: - During idle conditions, the keyboard lines are shorted out, generating a continuous high at the input to Q7; the printer lines are connected to a "selector magnet" (quaint) or a relay which is drawing a nominal 20 mA. -when the keyboard is sending characters, the KYBD lines are open-circuited for zero bits and shorted for one bits. When KIM sends characters on the PTR lines, it opens the circuit for zero bits by floating the output of O/C gate U26 (7438), and closes the circuit for one bits by pulling U26 to ground. Incidentally, this 7438 can sink up to 48 mA.

If you want to simulate this hardware with some other device, you need to feed the line labelled "TTY KYBD" with positive logic signals (low for ones, open for zeros) from the line labelled "TTY

PTR". You should note that the keyboard line has a 220-ohm pull down resistor on it, and that the printer line has no pull-up.

You may also notice, if your terminal has a FDX/HDX selector switch or jumper, that the FDX no longer works as advertised. This is just KIM trying to be helpful, with a wired-in interconnect which echos received characters on the output line. If this keeps you awake at night, cut the trace between pin 11 and U15 and pin 10 of U26, and connect pin 10 of U26 to Vcc. (I haven't tried it, but it should work. I'm a sound sleeper.)

If you need a for-example, I show a diagram of my own interface logic, based on a 7406 gate package, which is working quite satisfactorily. There are probably 1000 other ways of doing it, each one of which can be improved by SuperSilicon. If it works and doesn't smoke, have at it.



# **KIM™ BUS EXPANSION!**

**AIM™, VIM™, (SYM)™, KIM™ OWNERS**  
(and any other KIM™ bus users) buy the  
best 8K board available anywhere:

## **GRAND OPENING SPECIAL!**

## **HDE 8K RAM-\$169! 3 for \$465!**

Industrial/commercial grade quality: 100 hour high temp burn-in; low power: KIM bus compatible pin for pin; superior quality & reliability at below S-100 prices (COMMERCIALLY rated S-100 boards cost 25-75% more). When you expand your system, expand with the bus optimized for 8 bit CPU's, the Commodore/Mos Technology 2244 pin KIM bus, now supported by Syntek, MTU, Rockwell International, Problem Solver Systems, HDE, the Computerist, RNB, and others!

**KIM-1 computer \$179.00; KIM-4 Motherboard \$119; power supply for KIM-1 alone—\$45; enclosure for KIM-1 alone \$29; HDE prototype board with regulator, heatsink, switch address & decoding logic included \$49.50; book "The First Book of KIM" \$9.95; book "Programming a Microcomputer: 6502" \$8.95; SPECIAL PACKAGE DEAL: KIM-1, power supply, BOTH books listed above, ALL for \$209!**

**HDE FILE ORIENTED DISK SYSTEM (FODS) FOR KIM BUS COMPUTERS** Make your KIM (or relative) the best 8502 development system available at any price. Expand with HDE's full size floppy system with FODS/Editor/Assembler, 2 pass assembler, powerful editor compatible with ARESCO files KIM bus interface card: fast 6502 controller handles data transfer at maximum IBM single density speed for excellent reliability: power supply for 4 drives: patches to Johnson Computer/Microsoft BASIC. 45 day delivery. Single drive—\$1995 dual drive \$2750

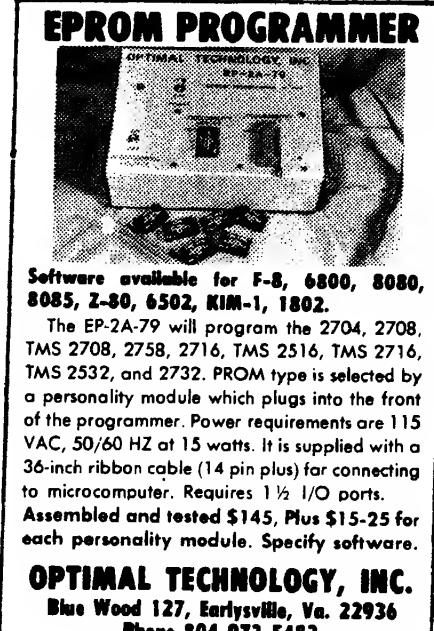
Shipping extra unless order prepaid with cashier's check ALL items assembled, tested, guaranteed at least 90 days.

**PLAINSMAN MICRO SYSTEMS (div. 5C Corporation)**  
P.O. Box 1712, Auburn, Al. 36830: (205)745-7735  
3803 Pepperell Parkway, Opelika  
(1-800-633-8724) Continental U.S. except Al.  
Dealers for OSI COMMODORE COMPUCOLOR

1074

## AL TOS

100



## THE INTEGER BASIC TOKEN SYSTEM IN THE APPLE II

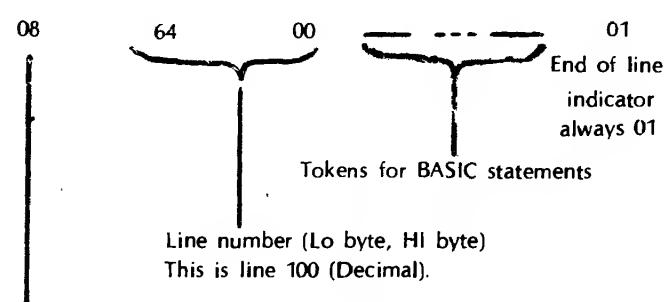
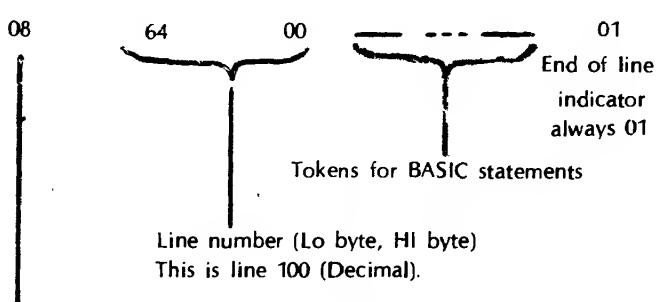
Frank D. Kirschner  
2643 Rockledge Trail  
Dayton, OH 45430

There are two primary methods of storing BASIC programs in microcomputers. One involves storing the entire program, letter by letter and symbol by symbol somewhere in memory, and interpreting the ASCII codes on execution. This is typical of BASIC compilers and some interpreters, like the TRS-80 Level 1. A more memory-efficient system uses tokens, eight bit bytes each of which represent a BASIC word or symbol. The TRS-80 Level II uses this method, as does the Apple II, to which the examples which follow apply.

When in Integer BASIC, the Apple stores characters as they are entered in a character buffer (hex locations 0200 to 02FF). When "return" is entered, BASIC "parses" the entry (that is, interprets the ASCII characters and breaks the instruction into executable parts). It determines what is a command, what are variables, data and so forth. If it is legal and is preceded by a number between 0 and 32767 (a line number), it stores it in memory in a fashion discussed below. If there is no line number, it simply executes the command and awaits further instructions.

The way the programs are stored is quite clever. When BASIC is initiated (control B or E000 G from the monitor) several things happen. First, the highest available user memory (RAM) is stored in memory locations 004C (Lo byte) and 004D (Hi byte), called the HIMEM pointer. Also, locations 00CA and 00CB, the start-of-program pointer, get the same numbers, since there is no program as yet. As program steps are entered, they are stored starting at the top of memory, highest line numbers first, and the start-of-program pointer is decreased accordingly. See Figure 1. When a line with a higher number than some already in memory is entered, they are shuffled to preserve the order. One application: if you enter a program and then hit control B, the program is **not** scratched (or erased); only the start-of-program pointer is affected. Since powering up the Apple fills the memory with a pattern of ones and zeros (it looks like FF FF 00 00 ...) from the monitor, it is easy to find the start of the program and then manually reset CA and CB to that location.

This is the way program instructions are stored in memory: (All numbers are in hex)



Number of bytes in BASIC line (also, one less than the number of bytes from the beginning of the next line).

Figure 2

As an example, power up the Apple, bring up BASIC, and enter  
100 PRINT 0,50

Enter the monitor (by pushing "reset"), and then examine the program by entering

EXAMPLES FOR  
16K Apple

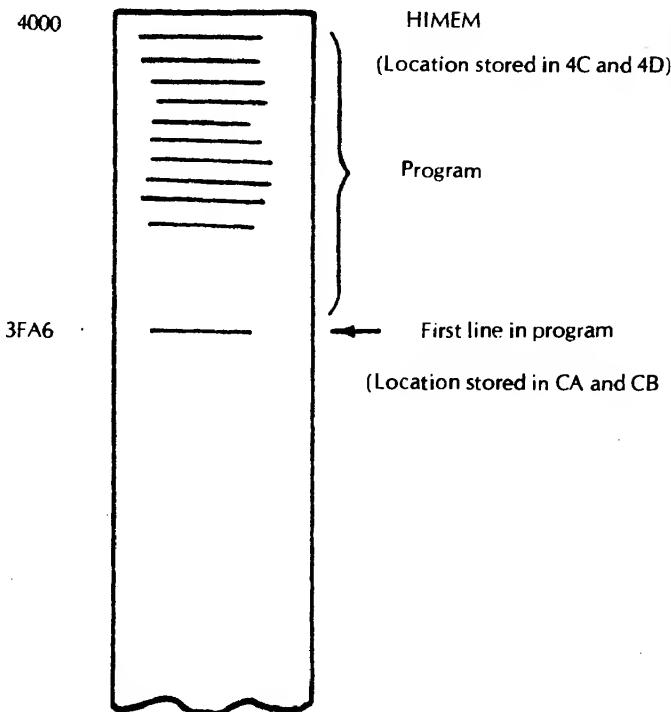


Figure 1

Memory Map for Program Storage

3FF4.3FFF return

(Locations for a 16K Apple. Subtract 2000 hex for a 4K or add 4000 hex for a 32K Apple.) You will see this:

3FF4 - OC 64 00 62  
3FF8 - B0 00 00 49 B5 32 00 01

which means:

OC

There are 12 bytes in this line

64

It is line 100 (Decimal)

62

PRINT (see Table 1 for complete list of tokens)

B0

The next two bytes are a number (rather than tokens)

00 00

The number 0

49

The comma in a PRINT statement

B5

Another number follows

32 00

The number 50

01

End of BASIC line

To demonstrate the use of this information, return to BASIC and try to enter the following BASIC line:

100 DEL 0,50

You will get a syntax error, because the Apple Interpreter does not allow the command DEL in deferred execution mode. Now do this: reenter the monitor and change the 62 (PRINT) to 09 (DEL) and the 49 (,for PRINT) to 0A (, for DEL) by entering

3FF7: 09 Return

3FFB: 0A Return

Reenter BASIC (control C) and list. Try this instruction by adding lines between 0 and 50, running the program, and then listing it. This allows you to write a program which will carry out some functions only the first time it is run and then automatically delete those lines.

In addition to inserting instructions which cannot be entered as deferred commands, you can modify the program under program control. As an example, here is a program which will stop and start listing a long program by hitting a key on the keyboard.

Bring up BASIC.

Enter: 257 LIST 0: RETURN

HIT RESET, 3FF6.3FFF RETURN

You will see

3FF6 - 0A 01

3FF8 - 01 74 B0 00 00 03 5B 01

What this means:

3FF6: 0A Ten bytes in line

3FF7,8: 01 01 LINE 257

3FF9: 74 TOKEN FOR LIST

3FFA: B0 Means "Number follows"

3FFB,C: 00 00 LINE TO BE "LISTED" (LO, HI)

3FFD: 03 TOKEN FOR COLON

3FFF: 01 End of BASIC LINE

Now enter 3FF7: FF FF Return

Cont. C, List

You have 65535 LIST 0: RETURN

Now enter

100 X=PEEK (-16384): POKE -16368, 0:1F

X 127 THEN 0: GOTO 100

Reset, 3FCF.3FFF Return

Change line no. from 100 to 65534 by entering 3FDO; FE FF Return

Change GOTO 100 to GOTO 65534 by entering 3FF3: FE FF

Change the 0 in "THEN 0" to 65533 by entering 3FEE: FD FF  
In like manner, enter these remaining steps: (Under each number which has to be entered through the monitor, the Hex equivalent, in reverse order as it must be entered, appears)

65533 I = I PEEK (I): IF I> PEEK (76) \*

(FD FF)

256\*PEEK (77) THEN END: GOTO

65531

(FB FF)

65532 X=PEEK (-16384):POKE -16386,0:

(FC FF)

IF X 127 THEN 65534

(FE FF)

65531 POKE 16374, PEEK (I+1): POKE 16380

(FB BB)

PEEK (I+2): COSUB 65535

(FF FF)

32767 I=PEEK (202) 256\* PEEK (203)

The steps must be entered in reverse order (i.e. descending line numbers) because the interpreter orders them by their number when entered, and will not re-order lines when the numbers have been changed through the monitor.

The reason for making all these line numbers very high is so the applications program will fit "under" the list program.

Now, in the monitor, move the start of program and HIMEM pointers below the program:

3A: 49 3F Return

4C: 49 3F Return

Hit control C and list. Nothing is listed. The program has been stored in a portion of memory temporarily inaccessible to BASIC. Load your applications program, make sure all the line numbers are less than 32767, and change HIMEM through the monitor (4C: 00 40) and execute RUN 32767. The program will list until you hit a key and then resume when you hit a key again. It uses the fact that each line begins with the number of bytes in the line followed by the line number. Numbers of successive lines are found and "POKE into the appropriate location in line 75535, which then lists each line.

Using these methods you can exercise considerably more control over the BASIC interpreter in your microcomputer.

## CLASSIFIED ADS

ZIPTAPE loads 8K BASIC in 15 seconds!

Slower than a speeding disc? Sure, but it only costs \$22.50 plus \$1.00 S&H.

\$3.00 extra for software on KIM cassette.

Described in MICRO No. 6. SASE for info.  
Lew Edwards, 1451 Hamilton Ave., Trenton,  
NJ 08629.

QUALITY SOFTWARE for the PET ...

Cheque-Check (best balancer!) \$7.95

Metric-Calc (RPN, with conversions) \$7.95

Mem-Explorer (learn PET details) \$7.95

Billboard ("Times Square" message of choice)  
\$49.95. Send check or money order to  
MICRO SOFTWARE SYSTEMS, Dept M479, P.O.  
Box 1442, Woodbridge, VA 22193. VA res.  
add 4% sales tax.

COVER-IT-UP! But - let the beauty of KIM-1 show through! Attractive, functional plexiglass enclosure protects KIM-1. Assembles in minutes with a screwdriver. Postpaid, only \$14.95. Guaranteed! Send check today:  
Cover-It-Up, 2120 N.W. 113, Okla. City, OK 73120.

Tabular Four-Way Number Conversion program for 16K Apple II. 20 lines of hex, decimal, octal, or binary numbers. Includes editing features, documentation. \$3.50. Microspan Software, 2213A Lanier Dr., Austin, TX 78758

**ADVERTISE IN MICRO FOR ONLY \$10.00 !**

A classified ad such as the one above, may be run in this section for only \$10.00.

Ad should not exceed six typed lines (we may have to cut longer ads "down-to-size") and only one ad per person or company per issue. Ad must relate to 6502 type stuff, and ad must be prepaid. Your ad will reach over 6000 readers - immediately !!!

TABLE I

## APPLE II INTEGER BASIC TOKENS

BASIC COMMAND OR FUNCTION	HEX TOKEN	BASIC COMMAND (CONT)	HEX TOKEN
ABS	31	LOAD	04
{	3F	MAN	0F
)	72	NEW	0B
ASC (	3C	Includes left paren.	NEXT
)	72		59
"	28	first quote	5A
"	29	second quote	79
AUTO	0D	NO DSP	7A
,	0A	NO TRACE	32
CALL	4D	PDL	3F
CLR	0C	(	72
COLOR=	66	PEEK	2E
CON	60	3F	(
DEL	09	72	)
,	0A	PLOT	67
DIM	4F	,	68
(	34	POKE	64
)	72	,	65
DIM	4E	POP	77
(	22	PRINT	63
)	72	PRINT	62
\$	40	:	Numeric Variable
DSP	7C	PRINT	If used alone
DSP	7B	"	61
END	51	"	String Variable
FOR	55	PR #	28
=	56	REM	Second
TO	57	RETURN	5D
STEP	58	RND	2F
COSUB	5C	(	3F
GOTO	5F	)	72
GR	4C	-	36
HIMEN:	10	SAVE	05
HLIN	69	SCRN (	3D
	6A	,	Includes (
AT	6B	)	3E
IF	60	SGN	72
THEN	24	{	30
	When followed by a	}	3F
	line no.	72	
THEN	25	TAB	50
	When followed by	TEXT	4B
	COSUB or a basic	TRACE	7D
	operation	VLIN	6C
INPUT	54	52	6D
INPUT	String Variable	Input if followed by ...	AT
INPUT	53		6E
,	27		VTAB
"	28	first	6F
"	29	Second	:
IN #	7F	Includes #	03
LEN (	3B	Includes (	=
LET	5E		71
LIST	74		In assignment
	75		AND
			1D
			OR
			1F
			MOD
			1F
			NOR
			DE

## PROGRAMMING THE 6502

by Rodney Zaks

Reviewed by  
John D. Hirsch  
Berme Road  
Kerhonkson, NY 12446

In the introduction to this book the author tells us it can be used by a person who has never programmed before. Chapter one does begin with a clear presentation of some basic techniques, such as binary arithmetic. But the quality of the book rapidly degenerates in succeeding chapters, which read as though they had been assembled from manufacturer's literature and other sources, with more help from a paste-pot than a pencil.

The quality of the writing is technical-manualese and the illustrations have the same mechanistic flavor. Also the illustrations and writing are sometimes only tenuously related. A novice programmer would probably give up along about Chapter 3, when assembly language routines are introduced even though assembly language is not explained until near the end of the book. The organization of the book has a certain random quality. For instance, integer addition, subtraction and multiplication are explained in some detail in the chapter on basic programming techniques, and then division is relegated to one paragraph while the chapter goes on to a very general explanation of subroutines. The experienced programmer will not find the book very helpful either. A good chunk of the book is taken up by reprinting 6502 instructions, one per page, and potentially valuable chapters—such as the one covering 65'xx interfacing chips—are very perfunctory. Dr. Zaks has the annoying habit of constantly referring the reader to manufacturer's data sheets for more details.

Chapter 9, covering data structures, is particularly puzzling. It covers data structures in a general way, with practically no information on how they can be implemented in 6502 assembly language. Perhaps the author intended this chapter for one of his other introductory computer books and pasted it in this one by mistake.

The publisher of this book has produced a good many other books which were either authored or co-authored by Dr. Zaks, all in a remarkably short time. Reading this book, it's easy to see how the trick is done.

The 6500 family software manual and Caxton C. Foster's charming introductory work *PROGRAMMING A MICROCOMPUTER: 6502* (Addison-Wesley) are still the best texts for learning to program in 6502 machine or assembly language.

Who regularly publishes more info on  
APPLEs, PETs, KIMs, SYMs, AIMs, and  
other 6502 based systems, products and  
programs than

**kilobaud**  
**BYTE**  
**INTERFACtE AGE**  
**creative computing**  
COMBINED?



that's  
who  
the full size magazine devoted to  
6502 information. Now published monthly \$12.00  
per year in USA.

Now you can get all of MICRO by buying  
"The BEST of MICRO Volume 1" for \$7.00  
(includes shipping) and starting your  
subscription with issue #7.

PO Box 3, S. Chelmsford, MA. 01824  
617/256-3649

## AIM PLUS™

### ENCLOSURE

WITH BUILT IN

### POWER SUPPLY

#### SPECIFICATIONS:

INPUT: 110/220 VAC 50/60 Hz

OUTPUT: +5V @ 5A

+24V @ 1A

GROUNDED THREE-WIRE LINE CORD

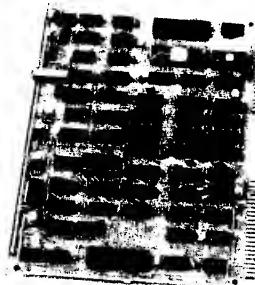
ON/OFF SWITCH WITH PILOT LIGHT

Enclosure has room for the AIM and one  
additional board: MEMORY PLUS or VIDEO PLUS



AIM PLUS: \$10000 AIM and AIM PLUS: \$47500

## VIDEO PLUS™ FOR AIM/SYM/KIM



UPPER/lower case ASCII

128 Additional User Programmable

Characters: GRAPHICS

SYMBOLS-FOREIGN CHARACTERS

Programmable Screen Format up to  
80 CHARACTERS - 24 LINES

KEYBOARD and LIGHT PEN Interfaces

Up to 4K DISPLAY RAM

Provision for 2K EPROM

Provision to add 6502 for

STAND-ALONE SYSTEM

ASSEMBLED AND TESTED  
WITH 2K DISPLAY RAM

VIDEO PLUS: \$24500

## MOTHER PLUS™ FOR AIM/SYM/KIM

ADD UP TO FIVE ADDITIONAL BOARDS

AUDIO/TTY CONNECTIONS

POWER TERMINALS

APPLICATION CONNECTORS

FULLY BUFFERED

FULLY DECODED

KIM-4 Bus Structure



MOTHER PLUS: \$8000

FULLY ASSEMBLED AND TESTED

## MEMORY PLUS™ FOR AIM/SYM/KIM



8K STATIC RAM LOW POWER

Sockets for 8K Eprom

6522 1/0 Port

ON BOARD REGULATORS

EPROM

PROGRAMMER

~~\$200.00~~

FULLY ASSEMBLED AND TESTED

MEMORY PLUS: \$24500



P.O. Box 3, So. Chelmsford, MA 01824  
617/256-3649

Chuck Carpenter  
2228 Montclair Place  
Carrollton, TX 75006

Renumbering Applesoft programs suddenly became possible. The resequence program in Jim Butterfield's "Inside Pet BASIC," (MICRO 8:39) solved the problem.

After clearing up a minor problem in the program (with help from Jim) I tried it on a 200 line program. Because of the way I started numbering in the first place, I had to fix-up about a dozen lines. But, I never would have gotten through that much renumbering otherwise.

As Jim mentioned in his letter to me, a machine language program would have ran a whole bunch faster. With DOS and having to find a place to locate such a program, the BASIC approach may be easier.

Here are some comments on the Applesoft version shown in Listing 1:

- Line 60005 has some prompting inputs to set-up the program.
- Use RUN 60005 to start renumbering.
- Line 60060 branches to a DELETED line.
- Line 60160 is changed to a point to the line no. in Applesoft (2049 or \$801).

Note: These are the pointers for Applesoft ROM

- Line 60160 was also changed to allow starting at any line number (M=LN-IN).

- Line 60170 changed to allow any numbering increment (M=M+IN).

\*
   
\*9A5L

03A5-	A5 67	LDA	\$67
03A7-	85 06	STA	\$06
03A9-	A5 68	LDA	\$68
03AB-	85 07	STA	\$07
03AD-	38	SEC	
03AE-	A5 69	LDA	\$69
03B0-	E9 03	SBC	#\$03
03B2-	85 67	STA	\$67
03B4-	R5 6A	LDA	\$6A
03B6-	E9 00	SBC	#\$00
03B8-	85 68	STA	\$68
03BA-	60	RTS	
03BB-	A5 06	LDA	\$06
03BD-	85 67	STA	\$67
03BF-	A5 07	LDA	\$07
03C1-	85 68	STA	\$68
03C3-	20 F2 I4	JSR	\$D4F2
03C6-	60	RTS	
03C7-	FF		???
03C8-	FF		???

\*

#### Listing 2

Applesoft append program. This program can be used to append any two programs together.

- Line 60220 - tokens changed for Applesoft (this information is in the Applesoft II manual).

- Line 60260 and 60270 added to delete the renumber program and end it.

To make using the program easier, an append program (also for ROM) does the job. The assembly language program shown in listing 2 links the two programs together. You only need to do this if you want to renumber an existing program. (You can still load the renumber program before you start a new program.) Here's how you use it.

- Load the append program first. It fits in page 3 starting at \$3A5.

- Load the lower line no. Applesoft program.

- Type Call 933 and (return).

- Load the higher line no. renumber program.

- Type CALL 955 and (return).

- Use RUN 60005 to start renumbering.

Be sure to record any output that appears on the screen. Write down the information and check the renumbering on the lines indicated. Putting longer line numbers in short spaces will be one message. Another will ask you to check where you used a THEN for a GOTO. The renumber program is not sure if it should renumber a line or a parameter.

My thanks to Jim Butterfield for providing us with such a useful program (and helping me get this one running). Also, thanks to Bob Matzinger from the Dallas Area Apple Corps for some modification suggestions and the Applesoft ROM append routine.

## LIST

```
60000  END
60005  HOME : PRINT : PRINT "RENUMBER:" : PRINT : INPUT "FIRST LINE # - ";LN: PRINT : INPUT "INCREMENT - ";IN
60010  LET T = 0: DIM VX(100),WX(100): GOSUB 60160
: FOR R = 1 TO 1E3: GOSUB 60210
60020  IF G THEN GOSUB 60090: NEXT R
60030  GOSUB 60160: FOR R = 1 TO 1E3:N = INT (M / 256): POKE A = 1,M = N * 256
60040  POKE A,N:V = L: GOSUB 60070:WX(J) = M: GOSUB 60170: IF G THEN NEXT R
60050  GOSUB 60160: FOR R = 1 TO 1E3: GOSUB 60210:
: IF G THEN GOSUB 60110: NEXT R
60060  PRINT "*END*": GOTO 60260
60070  LET J = 0: IF T < > 0 THEN FOR J = 1 TO T
: IF VX(J) < > V THEN NEXT J:J = 0
60080  RETURN
60090  IF V < > 0 THEN GOSUB 60070: IF J = 0 THEN T = T + 1:VX(T) = V
60100  RETURN
60110  GOSUB 60070: IF J = 0 THEN RETURN
60120  W = VX(J): IF W = 0 THEN PRINT "GO";"L";L;"?": RETURN
60130  FOR I = A TO B + 1 STEP - 1:X = INT (W / 10):Y = W - 10 * X + 48: IF W = 0 THEN Y = 32
60140  POKE I,Y:W = X: NEXT I: IF W = 0 THEN RETURN
60150  PRINT "INSERT";WX(J);"L";L: RETURN
60160  LET F = 2049:M = LN - IN
60170  LET A = F:M = M + IN
60180  LET F = PEEK (A) + PEEK (A + 1) * 256:L =
PEEK (A + 2) + PEEK (A + 3) * 256:A = A + 3:G =
L < 6E4
60190  RETURN
60200  LET S = 0
60210  LET V = 0:A = A + 1:B = A:C = PEEK (A): IF C = 0 THEN GOSUB 60170: ON G + 2 GOTO 60210,60190
60220  IF C < > 171 AND C < > 176 AND C < > 196
AND C < > S GOTO 60200
60230  LET A = A + 1:C = PEEK (A) - 48: IF C = - 16 GOTO 60230
60240  IF C > = 0 AND C < 9 THEN V = V * 10 + C:
GOTO 60230
60250  LET S = 44:A = A - 1: RETURN
60260  IEL 60000,60270
60270  END
```

### Listing 1

]

APPLE II Applesoft Version of Jim Butterfield's Resequence program.

## CLASSIFIED INDEX FOR ISSUES 7 TO 12

### APPLE

BREAKER: An Apple II Debugging Aid 7:5  
Rick Auricchio

MD\$ 16K RAM for the Apple II 7:12  
Allen Watson III

Apple Calls and Hex-Decimal Conversion 7:31  
Marc Schwartz

Apple II High Resolution Graphics 7:43  
Memory Organization  
Andrew H. Eliason

LIFE for your Apple 8:11  
Richard F. Suttor

An Apple II Program Relocator 8:31  
Rick Auricchio

An Apple II Page 1 Map 8:41  
M. R. Connolly Jr.

Exploring the Apple II DOS 9:9  
Andy Hertzfeld

Two Apple II Assemblers: 9:19  
A Comparative Review  
Allen Watson

How Does 16 Get You 10 9:32  
Gary P. Sandberg

Apple II - Trace List Utility 10:9  
Alan G. Hill

6522 Chip Setup Time 10:17  
John T. Kosinski & Richard F. Suitor

An Apple II Program Edit Aid 11:5  
Alan G. Hill

A Cassette Operating System for the Apple 11:21  
Robert A. Stein, Jr.

S-C Assembler II 12:9  
Chuck Carpenter

The Integer BASIC Token System in the Apple 12:41  
Frank Kirschner

Renumber Applesoft 12:45  
Chuck Carpenter

### OSI

The OSI Flasher: Basic Machine Code 10:41  
Interfacing Robert E. Jones

A Close Look at the Superboard II 11:15  
Bruce Hoyt

Real-Time Games on OSI 12:31  
David Morganstein

**GENERAL**

6502 Interfacing for Beginners: 7:17  
Marvin L. De Jong

The Control Signals 8:5  
Buffering the Busses  
An ASCII Keyboard Input Port 9:11

6502 Bibliography 7:33  
William R. Dial

Part VI  
Part VII  
Part VIII  
Part IX  
Part X

The MICRO Software Catalog 7:33  
Mike Rowe

Part IV  
Part V  
Part VI  
Part VII  
Part VIII

6502 Information Resources 7:35  
William R. Dial

650X Opcode Sequence Matcher 7:19  
J. S. Green

A 100 uS 16 Channel Analog to Digital Systems 12:25  
Converter for 65XX Microcomputer Systems  
J. C. Williams

Programming the 6502: by Rodney Zaks 12:44  
Review by John D. Hirsch

Cartoons 9:13, 9:21, 9:38  
Bertha B. Kogut

## KIM, KIM, SYM, AND AIM

KIM-1 as a Digital Voltmeter  
Joseph L. Powlette & Charles T. Wright 7:37

Cassette Tape Controller  
Fred Miller 7:39

A Digital Clock Program for the SYM-1  
Chris Sullivan 7:45

KIMBASE  
Dr. Barry Tepperman 7:49

Storage Scope Revisited  
Joseph L. Powlette & Donald C. Jeffery 8:29

SYM-1 Tape Directory  
John Gieryc 8:35

Two Short IIM Programs  
Gary L. Tater 9:14

ASK the Doctor  
Robert M. Tripp 9:17

Part I - An EPROM Programmer  
Part II - Bits and Bytes 10:31

Part IV - Good News/Bad News 11:25

Expand Your 6502-Based TIM Monitor  
Russell Rittmann 12:35

9:26

Life for the KIM-1 and an Xitex Video Board  
Theodore E. Bridge 9:39

A Simple 24 Hour Clock for the AIM 65  
Marvin L. De Jong 10:5

Using Tiny BASIC to Debug Machine  
Language Programs  
Jim Zuber 10:25

6502 Graphics Routines  
Jim Green 10:43

Corrected KIM Format Loader for SYM-1  
Nicholas J. Vrtis 11:12

EKIM or MAXI-KIM  
Andrew V. W. Sensicle 11:19

SYM-1 6522-based Timer  
John Gieryc 11:31

The TVI-6: A User's Report  
Edward Chalfin 11:34

## PET

PET Update  
Gary Creighton 7:13

A Memory Test Program for the PET  
Michael McCann 7:25

Peeking at PET's BASIC  
Harvey B. Herman 7:47

Continuous Motion Graphics or How to Fake  
a Joystick with the PET  
Alan K. Christensen 8:23

Inside PET BASIC  
Jim Butterfield 8:39

The Sieve of Eratosthenes  
Gary J. Bullard 9:08

How Goes Your ROM Today?  
Harvey B. Herman 9:35

High Resolution Plotting for the PET  
John R. Sherburne 10:19

"Thanks for the Memories" A PET Machine  
Language Memory Test  
Harvey B. Herman 10:37

Lifesaver  
J. Stelly 11:9

The Ultimate PET Renumber  
Don Rindsberg 11:37

A PET Hex Dump Program  
Joseph Donato 12:13

11:9

An AIM 65 User's Notes  
Joe Burnett 12:5

Super HI-LO for the SYM-1  
John Gieryc 12:17

A 100 uS 16 Channel Analog to Digital  
Converter for 65XX Microcomputer Systems  
J. C. Williams 12:25

Inside the KIM TTY Service  
Ben Doutre 12:39

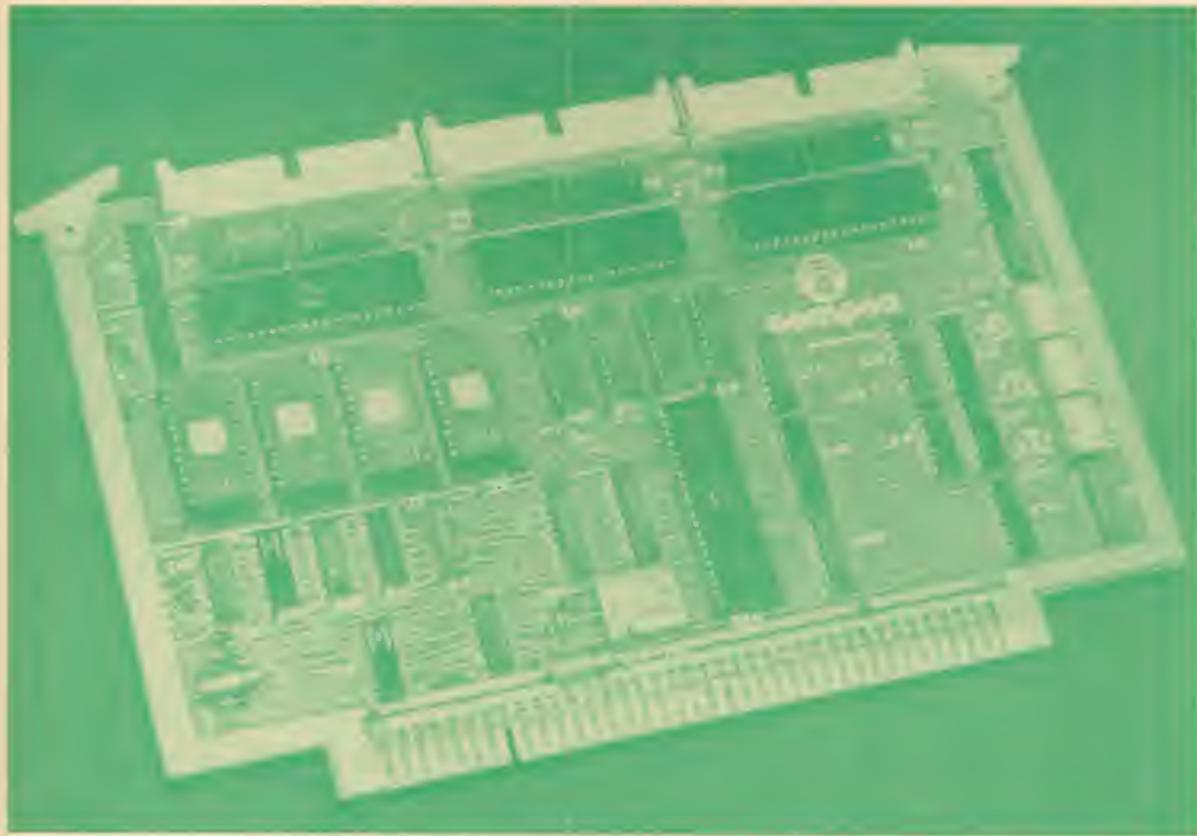


**COMPASS**  
**microsystems**

224 S. E. 16th Street  
P.O. Box 687  
Ames, Iowa 50010  
Phone 515-232-8187

## single board computers

### CSB 1



### THE 6500 BASED SINGLE BOARD COMPUTER YOU HAVE BEEN LOOKING FOR

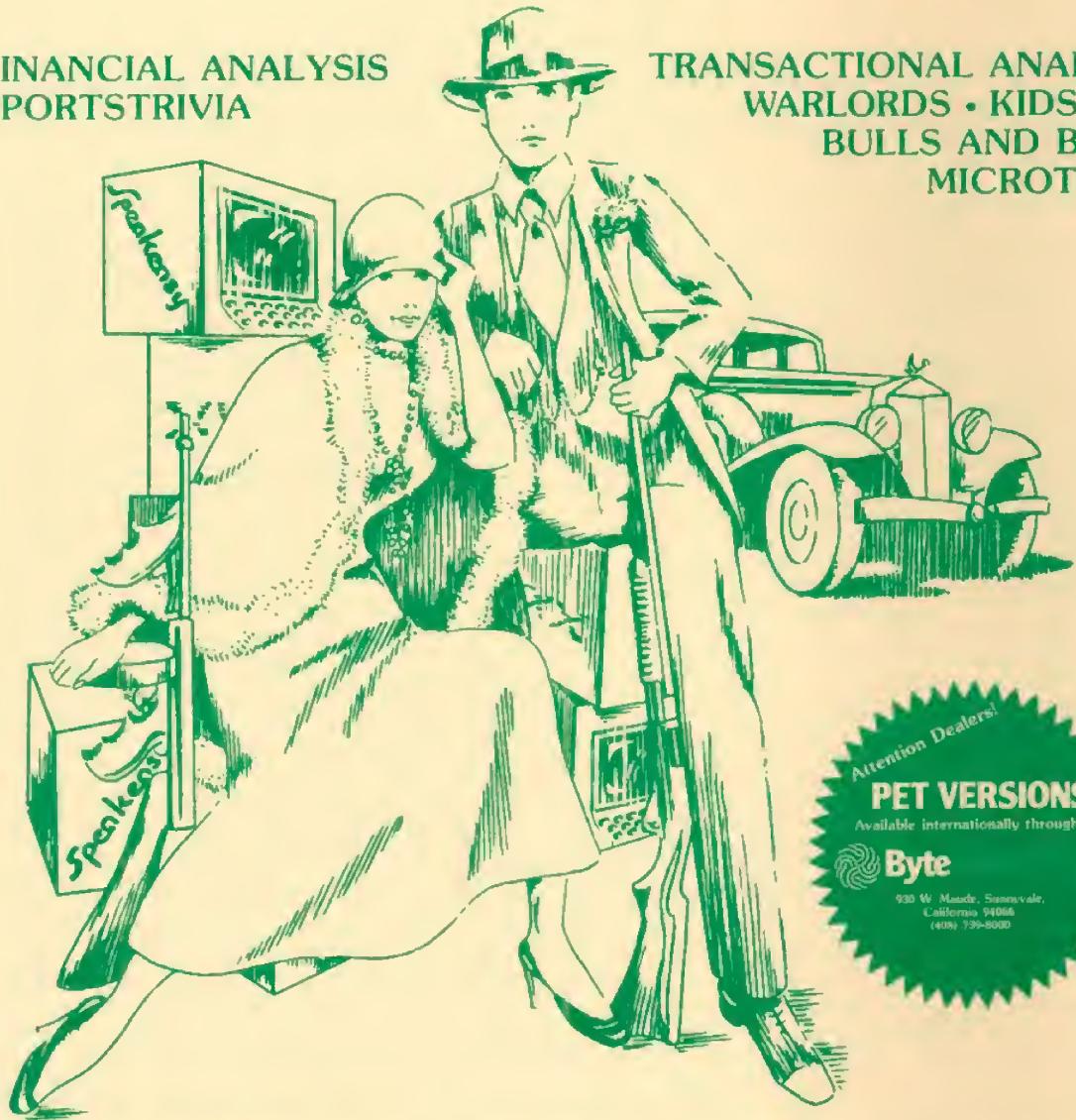
An industrial quality 6500 based single board computer produced by the company known for quality 6500 hardware and software. CSB 1 includes a 6502 processor, four ROM/EPROM sockets, 2K bytes RAM(2114), two PIA(6520) and one VIA(6522) chips. All addresses are switch selectable and a single +5 volt power supply is needed. Board size is 6 by 9.75

inches. The gold plated edge connector adheres to the SYSTEM 65 bus standard. Single quantity price is \$595 with substantial quantity discounts available. Other CSB board products are available or in design. Call us today for further information on our CSB family or any of our other 6500 support products.

# Speakeasy Software<sup>TM</sup>

FINANCIAL ANALYSIS  
SPORTSTRIVIA

TRANSACTIONAL ANALYSIS  
WARLORDS • KIDSTUFF  
BULLS AND BEARS  
MICROTRIVIA



Attention Dealers!  
**PET VERSIONS**

Available Internationally through

**Byte**

930 W. Maude, Sunnyvale,  
California 94086  
(408) 739-8000

## APPLE • PET • TRS~80

Now available at over 1,000 stores worldwide!

Speakeasy Software

LTD.

Box 1220, Kemptville, Ontario, Canada, K0G 1J0

(613) 258-2451